ISSUE 199 SEPTEMBER 2010

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Easy-to-Build Display Case p.68

37 Shop Tips Inside!

More Great Projects

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- **Sanding Center** p.62
- **Toy Bulldozer** p.56
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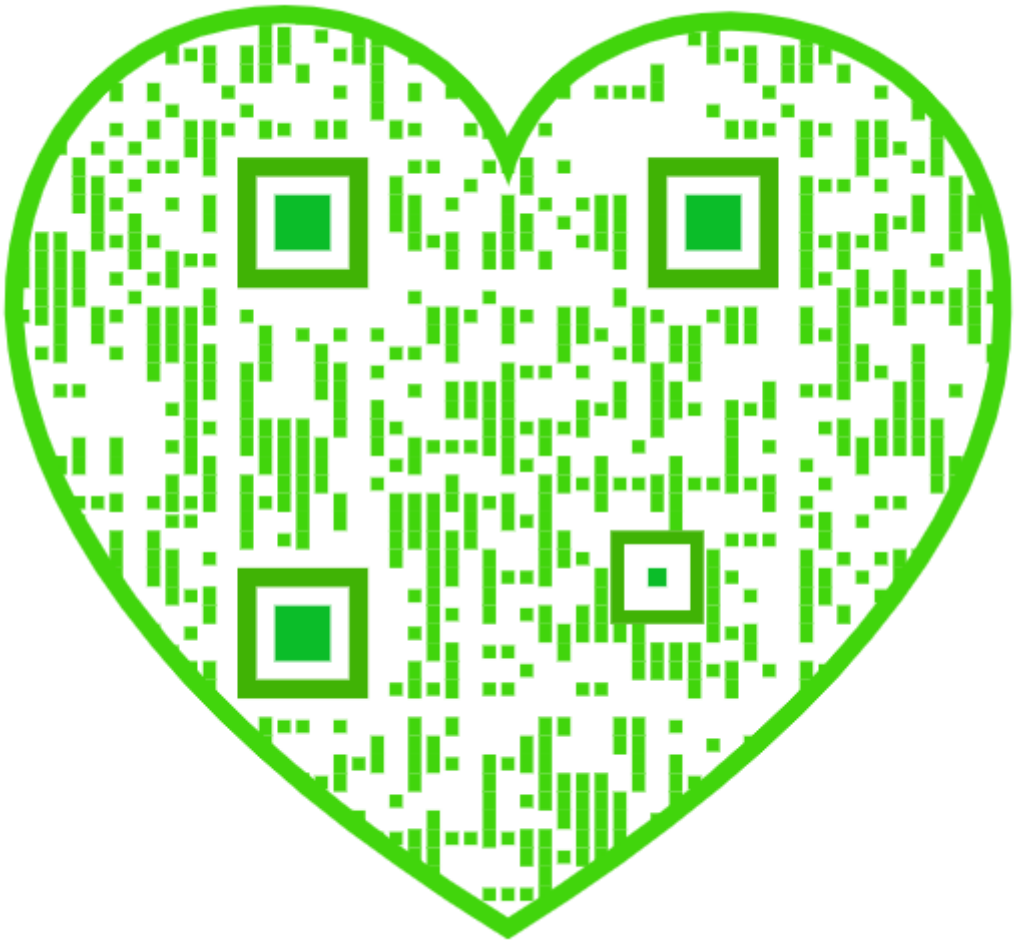

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This seal is your assurance that we build every project, verify every fact, and test every reviewed tool in our workshop to guarantee your success and complete satisfaction.

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on the web

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A NEW FREE PLAN EVERY WEEK!

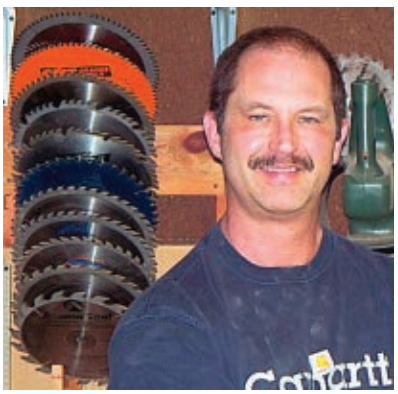
Visit woodmagazine.com/plangiveaway every Thursday during July and August to download one FREE project plan, such as the lighted showcase shown at *right*. You'll also find plans for everything from a workbench to toys to a picture frame.

PUT SAFETY AT THE TOP OF YOUR LIST

As you'll read on *page 28*, not heeding simple power-tool safety rules can have life-changing results. Before you head to the shop next time, bone up on safety procedures using the info at woodmagazine.com/safety.

LEARN FROM THE MASTERS

Click on the "Better Woodworking" logo at woodmagazine.com/videos to download how-to videos from today's biggest names in woodworking, including Marc Adams, Gary Rogowski, Jim Heavey (*right*), The Wood Whisperer, and many more.



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Check out the "Community" section at WOOD Online, where you can talk shop with woodworkers all over the world in our best-on-the-'Net forums (woodmagazine.com/forums) and learn from a variety of expert bloggers (woodmagazine.com/expertblogs), such as Scott Spencer, "The Ace of Blades," at *left*.

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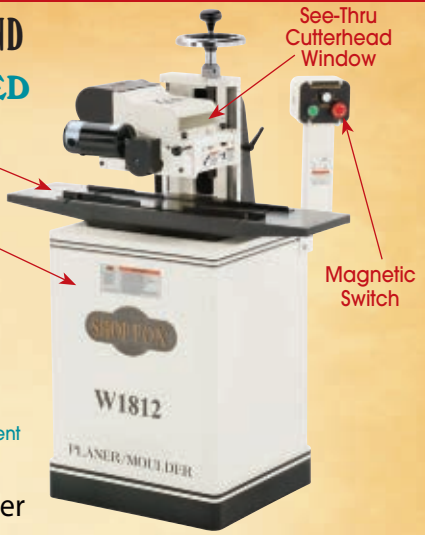

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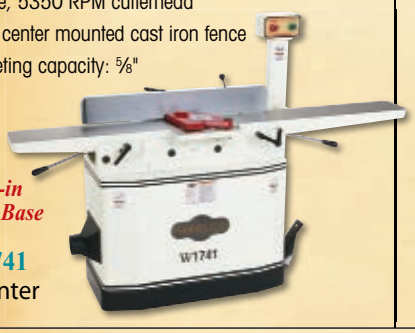

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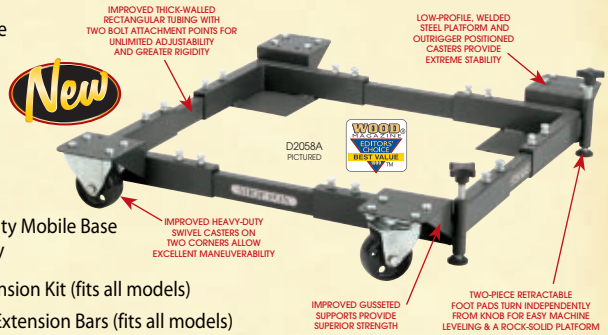
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At the top of my shop wish list is

...more shop time!

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...upgrading the wiring in my garage shop with new circuits separate from the house circuits.

...building a true woodworker's workbench with traditional vises and a laminated maple top.

...a garage addition to get more square footage for the shop.

...making everything in the shop mobile.

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Contributing Illustrators **TIM CAHILL, LORNA JOHNSON, ROXANNE LeMOINE**
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Jury award for tablesaw injury stirs up woodworkers

A jury in U.S. District Court in Boston awarded $1.5 million to a workman who injured his hand while making a freehand taper-cut on a piece of flooring using a benchtop tablesaw. His lawyers argued the tablesaw should have had flesh-detecting technology. (See "Tablesaws on Trial" on *page 28*.) Here are some reactions to the news, as culled from the General Woodworking forum at woodmagazine.com/forums.

Awards like this do nothing but raise the price of products due to lawyers and politicians making laws and decisions that try to protect people from themselves.

—Bob259

It's nice to see that there is a technology that will prevent injury, but it's still my responsibility to use equipment in a safe manner. By making this decision...[the jury] has shown its own lack of responsibility.

—Ken Derpack

I wonder how many woodworkers were on that jury. Imagine what kind of fear the lawyers can conjure up when there is no one there to present the woodworker's point of view. If you haven't used a tablesaw, and have had no instruction as to how to use one safely, the idea of having a 10" blade spinning at over 3,000 rpm could be mighty scary.

—Randy@Yorktown

If the technology is available and it protects life and limb, by all means make it part of the cost. I'm tired of paying huge insurance premiums because some people want to save a few bucks up front. Make the saw manufacturers put such safety features in place. Let them figure how to reduce cost.

—Ponderless

Beware of potential dangers with pallets

As a warehouse worker for over 30 years, I know you can get some wonderful lumber from crates, pallets, and wood containers. But you can also get into trouble. First, not all pallets are free for the taking, even though a business makes them available. This is because some companies lease pallets and never sell them or give them away. These are often identified by color-coded paint. Another serious caution: Know what the pallet was used for. I dealt with hazardous material for 10 years, and saw many pallets, such as the one *above*, contaminated with acids, metal etchants, cyanide, and other harmful products. And most pallets originating from outside the U.S. must be treated to kill insects, such as emerald ash borer. The company I worked for destroyed contaminated pallets, but many do not.

—David Duvall, Wilmington Ill.

Not enough space for jewelry? Not a problem

I loved the plan for the Jewelry Chest in issue 191 (July 2009), *left*, but wanted to make it larger with a few more drawers. So I "stretched" the chest to nearly twice as wide and 2" taller. As you can see in the photo at *right*, my version has two doors, two extra small drawers, a larger drawer below, and a removable tray for small pieces of jewelry. Upon completion, I realized my chest included 94 pieces of wood! Thanks for the inspiration.

—W. Leroy Eheart, Barboursville, Va.

HOW TO REACH US

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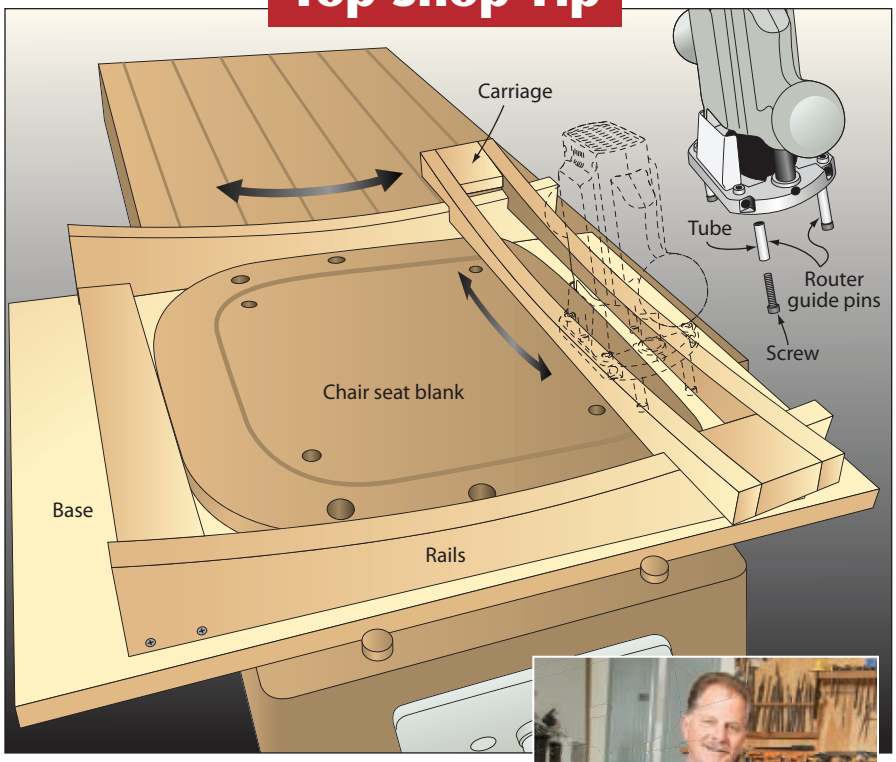

Seat-sculpting jig saves time and keisters

After years of using an adze, scorp, and curved-bottom plane to rough out chair seats, I came up with this router jig to quickly carve a symmetrical hollow for a nearly finished seat.

To make the jig, first equip your plunge router with guide pins made by slipping 2"-long machine screws through steel sleeves (available from home centers). If your router base doesn't already have four tapped holes, drill and tap your own or make a subbase to accommodate them.

Construct the jig base (I used ¾" MDF) to fit snugly around your chair seat blank and form the rail and carriage curves to fit snugly around your—ahem—curves. It might take some trial and error to get them just right. The depth of the curves on my rails ranges from 0" at the end of the arcs to ¾" in the middles.

Space the carriage rails to capture the router guide pins while allowing them to slide freely. Notch the bottom of the carriage so it fits snugly over the base rails but still moves front to back.

Clamp the jig base to your workbench; then double-faced-tape the seat blank in the jig, centering it on the arcs. Chuck a ½" straight bit in your router. Then, nibbling away about 3/16" in a pass, run the router side to side on the upper carriage rails. After one pass, slide the upper carriage forward for the next. It takes about 30 passes to cover the entire seat. Then lower the bit another 3/16" for the next round of passes, and continue until you reach the desired depth.

The router does most of the rough sculpting work for me. All that remains is a little fine-tuning with a scraper or a power sander.

—Bob Hockema, West Lafayette, Ind.

continued on page 10

Photo: David Elmore

For his time- and cheek-saving tip, Bob receives a dream kitchen cabinetmaking router bit package, with instructional DVDs, from Sommerfeld Tools.

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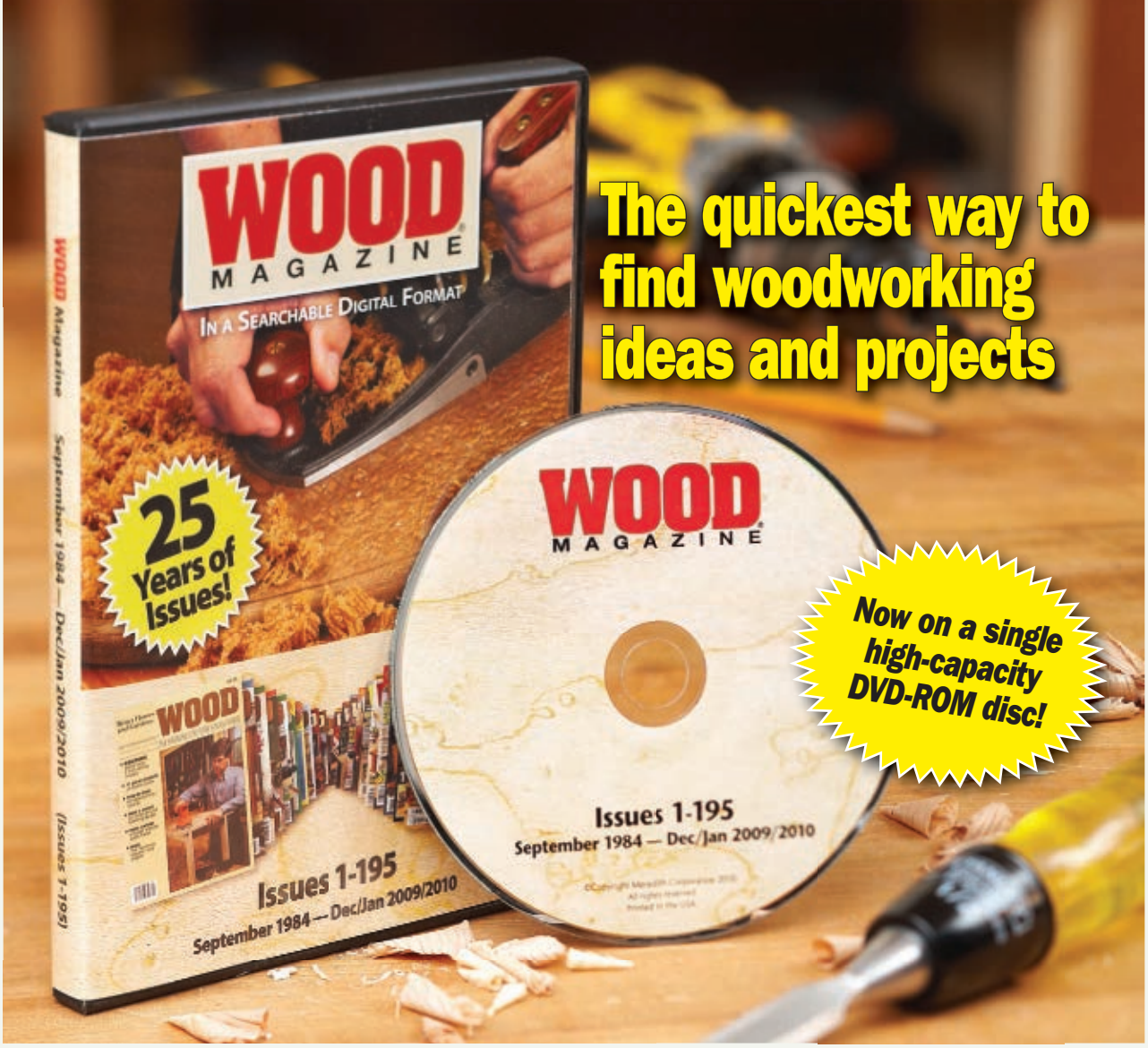
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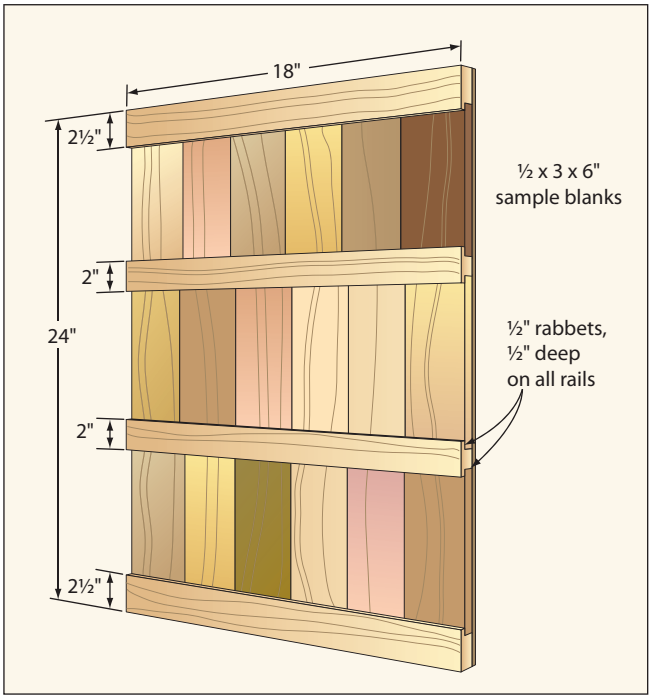
Shop Tips

The history of your shop as told by scrapwood

I enjoy using colorful, exotic woods to craft small woodworking projects. When I make a project from a new wood, I cut a ½×3×6" sample piece of the wood. I write the name of the wood on the back in permanent marker and apply a coat of Danish oil to bring out the grain. The display board, shown *below*, shows off the samples in my shop. It's made from a ¼" hardboard backer with rabbeted hardwood rails. The samples serve as a good conversation piece as well as a reminder of past projects.

Not coincidentally, the sample size listed above is the standard specimen size for the International Wood Collectors Society (www.woodcollectors.org), but if you're not a serious collector, size your samples and board to fit your space or scrap.

—Ken Minnaert, Olympia, Wash.

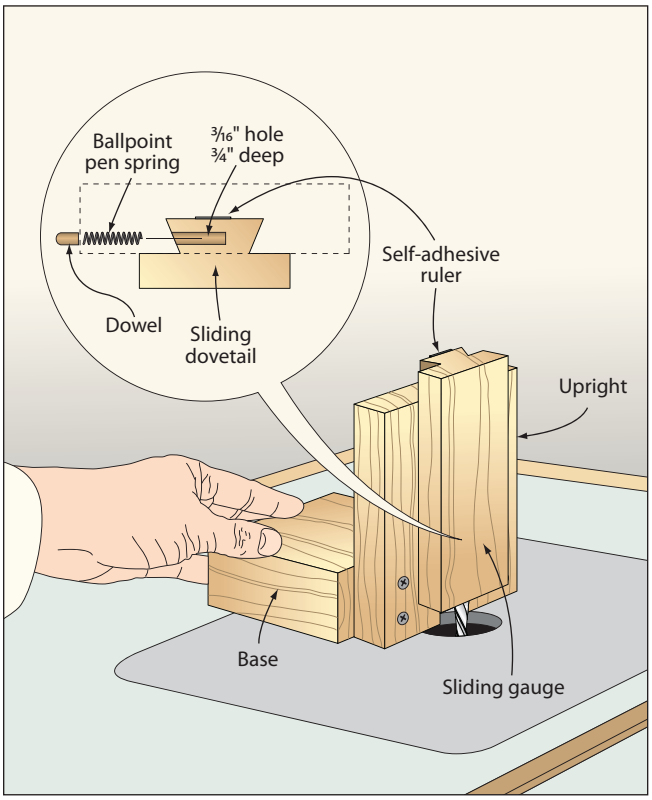


Easy multi-tasking height gauge

After trying numerous store-bought blade- and bit-height gauges, I came up with my own simple version that works great for multiple tools: tablesaw, router table, plunge router, etc.

The hardwood base holds an upright—grooved vertically to hold a sliding dovetail. Size the mating dovetail on the sliding gauge so it slides freely. Attach a self-adhesive rule to the face of the dovetail. Then drill a 3/16" hole, ¾" deep in one side of the dovetail to fit a ballpoint pen spring and a small dowel. This gives the gauge a friction-fit to hold it at a set height.

—Junior Strasil, Falls City, Neb.



continued on page 12

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How Do You Create Endless Cabinet Door Making Possibilities?

Profile Shown:
Round Over
(#99-760)

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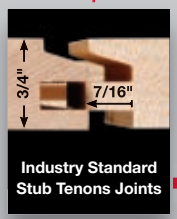

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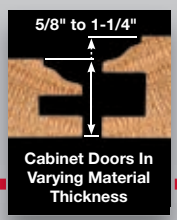

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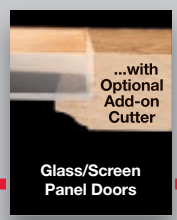

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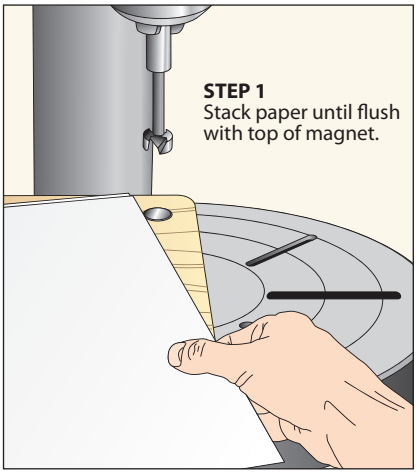
Shop Tips

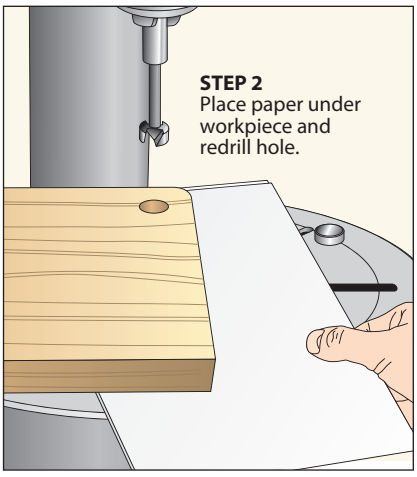
Paper-thin drill press precision

The hole I drilled to house a magnetic door catch was just a hair too shallow. Rather than go through tedious trial and error—and risk drilling too deep, here's what I did.

Leaving the drill's depth setting unchanged, I seated the magnet in the hole. Next, I stacked printer paper next to the magnet until the stack was flush with the magnet. Then I slid the stack of papers underneath the door raising it just enough to redrill the hole at a perfect depth.

—Charles Mak, Calgary, Alta.





Find FREE plans for your shop at
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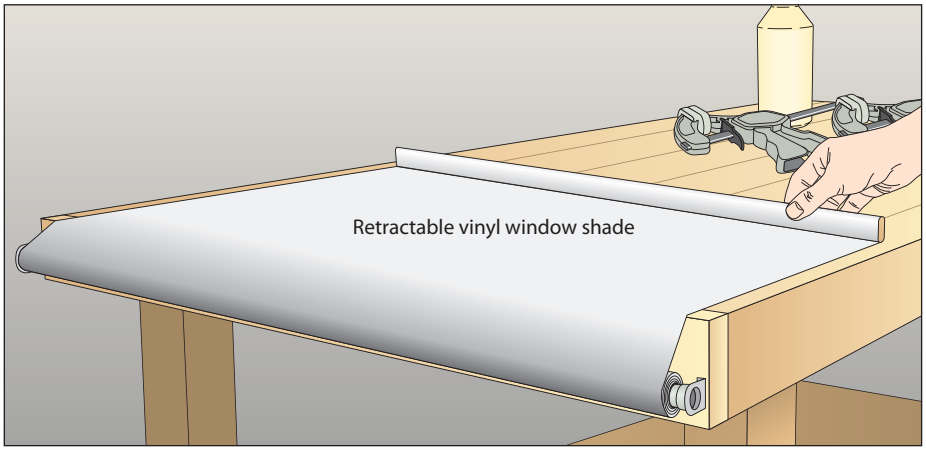
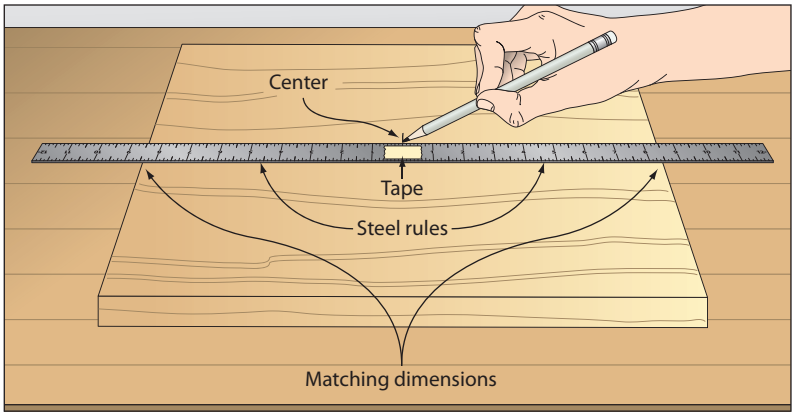
It's curtains... er, shades... for you, workbench spills!

To keep my workbench free of paint and varnish spills as well as glue drips, I mounted a retractable vinyl window shade to one end. Before a messy operation, I pull the shade across the bench and clamp the end to the bench.

Cleanup is a snap. I simply let the mess dry and retract the window shade. Much of the dried drippings peel off as the shade rolls up.

—John Larson, Coon Rapids, Minn.





Poor-man's centering rule

Next time you need to mark the center of a workpiece, slide the 0" ends of two steel rules together and fasten them with a piece of tape or a rare earth magnet. Adjust the rules on the workpiece until the measurement at the edges reads the same on both rules, then mark the center where the rules meet.

—George Schok, Churchville, Pa.

continued on page 14

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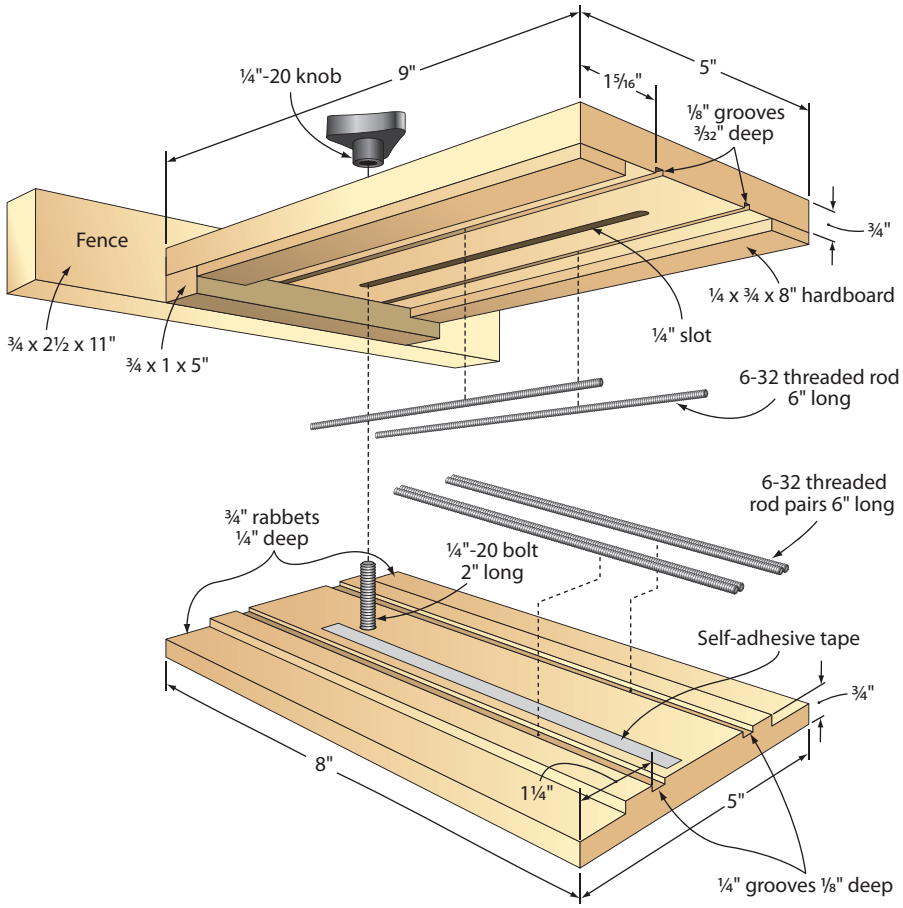
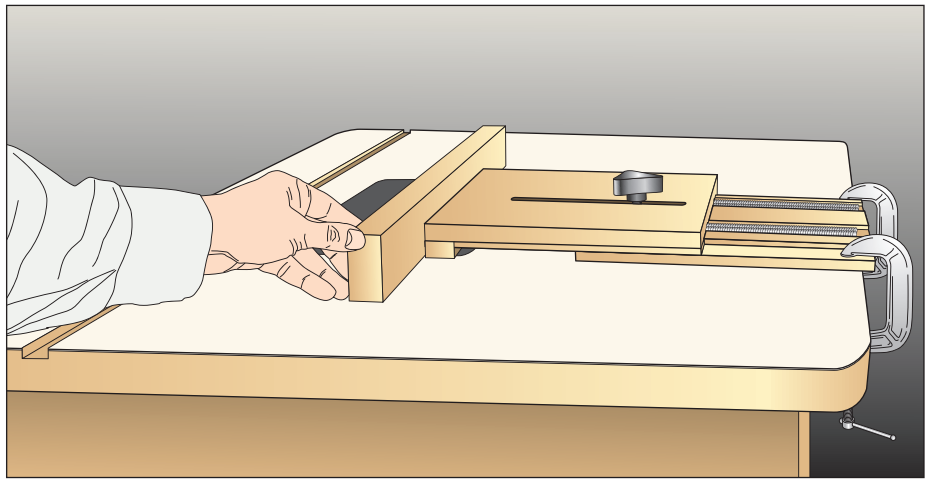
Eking precision out of threaded rod and scrap

Here's my shop-made version of a micro-adjustment jig for use as a router-table fence. I made mine out of inexpensive MDF to the dimensions shown. The threaded rod, which is epoxied into the grooves, has 32 threads per inch allowing you to position the fence in precise 1/32" increments. The knob then locks it in place. To make minute adjustments, just unlock, move a step, and re-lock.

—Frank DiMezzo, Rome, N.Y.





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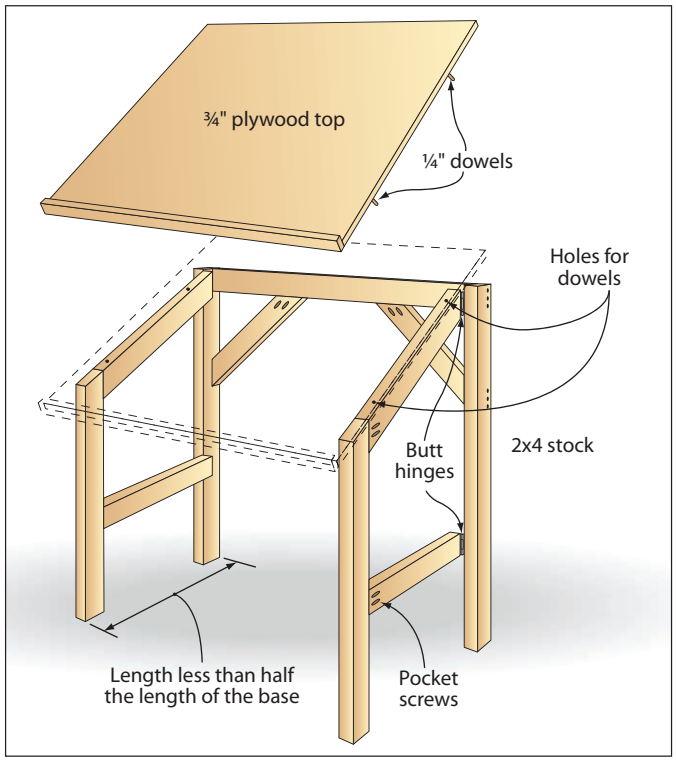
Pack-along worksurface

As a contractor, I grew tired of kneeling on the floor or leaning over the hood of my pickup to review construction drawings. So I came up with this cheap field table from on-site scraps to save my knees, back, and sanity.

Pocket screws hold the sides and back together. Hinges allow the entire thing to fold flat at the end of the day. Dowels underneath the plywood top drop into holes in the angled top rails to hold the temporary work surface together.

—Ken Rexing, Evansville, Ind.

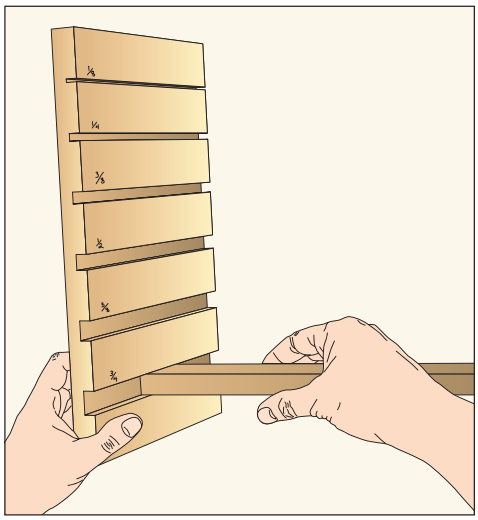


Sneak up on a perfectly planed workpiece

Don't trust your planer's thickness indicator? For perfectly thicknessed stock, make this reference gauge. To ensure precision, cut the dadoes with straight router bits ranging from ⅛" to ¾"; then label them with a fine-tip marker.

After each pass on the planer, check your stock for fit in the appropriate dado. When the planed piece slides in, your thickness is perfect.

—Keith James, Reno, Nev.



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Power Your Way to a Polished Finish

Rub out film finishes to a high shine using this modern alternative to traditional messy powders and oils.

Some woodworkers brush on a few coats of varnish and wonder why their finish doesn't look gallery-smooth. Truth is, a silky film finish *starts* where the label directions *stop*. After the final coat cures, a savvy finisher traditionally digs out his pumice or rottenstone (powdered abrasives) and lubricant, and hand-rubs the finish to an even sheen without dust nibs, runs, or a "plastic" look. If that process seems time-consuming and messy, you can see why most guys rub out only horizontal surfaces, such as a tabletop, where light best reflects off the finish.

For a faster, cleaner method, try the techniques used by auto-body experts. Instead of oils, powders, and handheld rubbing blocks, they use premixed automotive polishing compound and a foam buffing pad on a dedicated polisher. You can achieve similar results using your random-orbit sander.

A finish worth the wait

You can rub out nearly any film finish, including polyurethane, lacquer, and shellac. With the latter two, each topcoat bonds with the one beneath it to form one single layer. With poly, though, you'll want to apply a full-strength final coat to avoid cutting through to the layer below.

Although a rubbed finish solves some problems, it highlights others if you shortchange the surface preparations. For example, a porous wood, such as red oak, looks pockmarked because the pores don't fill with finish. To prevent that, always seal porous woods with a coat of the finish you'll use for your topcoat. Then fill the pores with a commercial compound such as Behlen's Por-O-Pac. (See **Sources**.) Follow that with three coats of film finish as close to full strength as you can apply.

continued on page 18

BEFORE AND AFTER RUBBING OUT

Before it was rubbed out, the satin finish (*left*) blurred objects and highlighted surface flaws. After rubbing (*right*), the sheen becomes more even in reflected light despite not being glossy.

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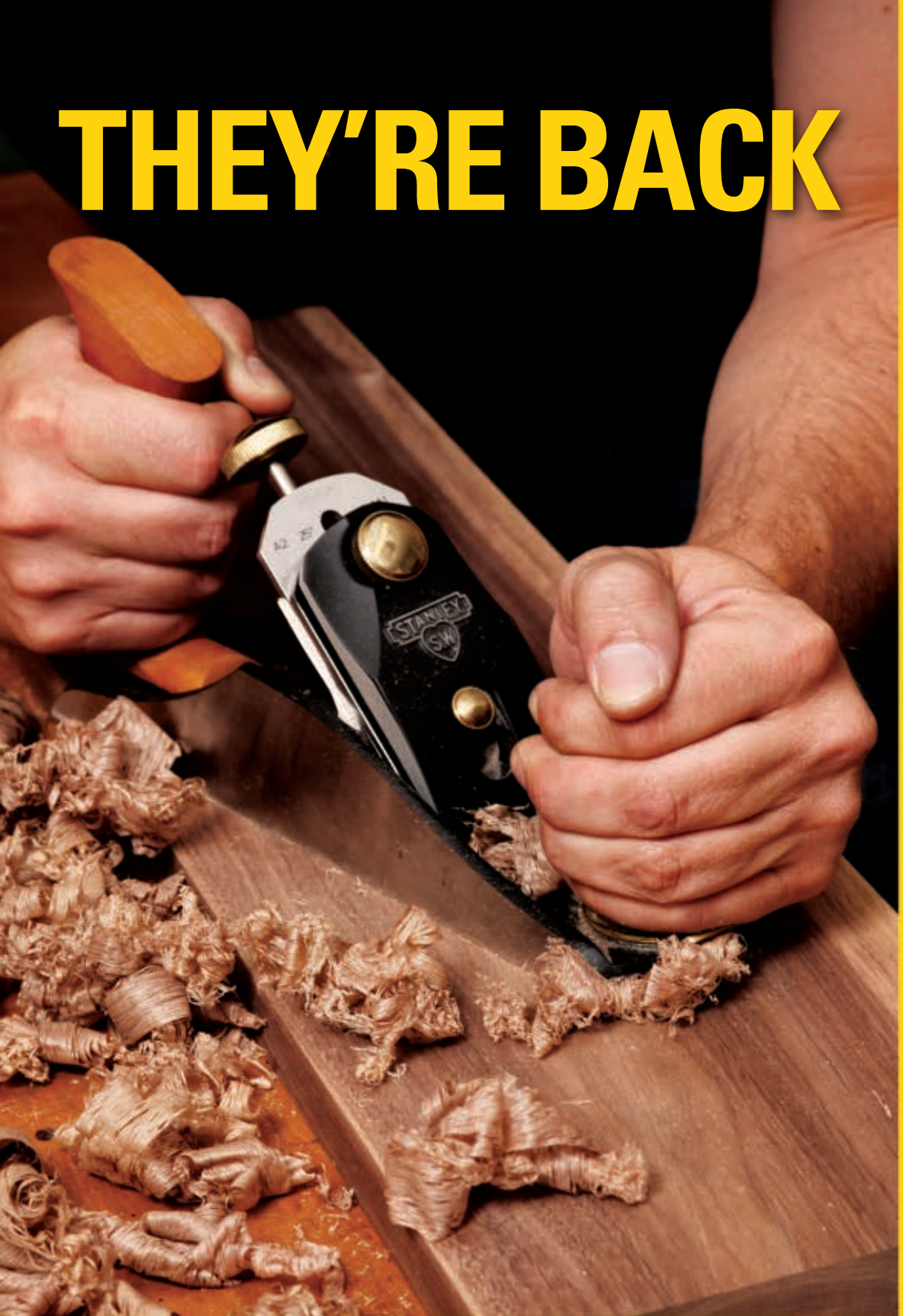
THEY'RE BACK



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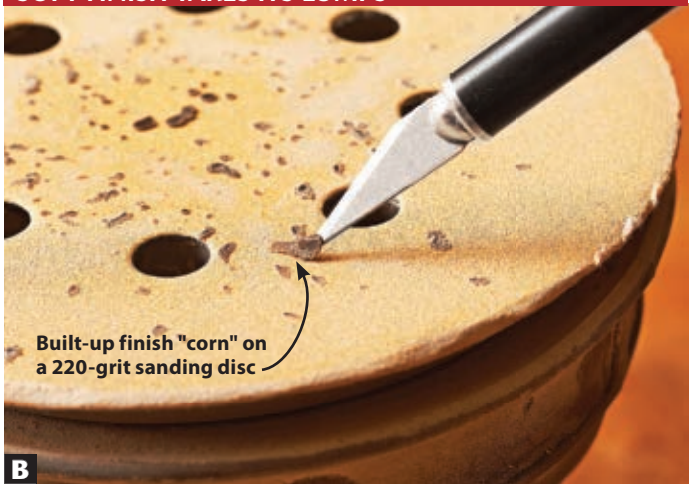
FIRST, FIX FINISH FLAWS

Before you rub out a finish, first sand away dips and runs. Then reapply an even topcoat and check for flaws using an angled light.

SOFT FINISH TAKES ITS LUMPS



When finish heats and softens, it can stick to itself to form corns on an abrasive. Remove these or change pads frequently.

SHOP TIP

Polish your rubbing skills with the right tool

Your random-orbit sander handles occasional jobs rubbing out a finish, but you'll speed the process even more using a dedicated electric polisher. A polisher for rubbing out furniture finishes should have a variable-speed control for slow-speed work that won't overheat your finish. Attach yellow buffing pads to the rubber backer using the center washer nut, or replace the original pad with a hook-and-loop aftermarket pad.

CORNS CUT CIRCULAR SCRATCHES

Stop sanding immediately if you notice circular patterns in the sanding dust caused by corns on the sanding disc.

Brush on each coat as evenly as possible close to the edges to avoid sanding or rubbing through the finish there. However, avoid applying extra-heavy coats. Yes, thick coats protect against sand-through, but they also drip and sag more than moderate coats. And a heavy finish takes longer to cure.

Rubbing only works on a fully cured film finish. On anything less, you'll only smear the finish instead of polishing it. To tell when a finish has cured, sniff it. If you smell solvents, it needs more curing time.

Sand the surface flat

Begin sanding the finish with 220- or 320-grit stearated sandpaper to remove dust nibs, brush strokes, and runs or dips [**Photo A**]. If you use a random-orbit sander with 220- and 320-grit discs, watch for build-up on the abrasive [**Photo B**]. This can form lumps, called "corns," that mar the finish instead of smoothing it. Stop immediately and clean the disc if you see loops in the surface dust [**Photo C**].

After you reach the 400- through 1,000-grit abrasives, switch to hand-sanding with wet/dry sandpaper lubricated with mineral oil. Sand with the grain, and clean the surface using mineral spirits and a soft, clean cloth after each grit.

Note: *As you gain finish-sanding skill using mineral-oil lubricant, save time and mess by switching to a lubricant that lets abrasives cut faster. Make your own from 1 tablespoon of dish-washing liquid in 1 quart of water. Be careful: Fast-cutting lubricants increase the risk of sanding through the finish.* When you have an even sheen, you're ready to polish.

continued on page 20

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Shine time

Place your sanded and cleaned workpiece on a non-skid mat to keep it from shifting as you polish. Then center and attach a yellow buffing pad (**Sources**) to the hook-and-loop pad of your random-orbit sander.

After shaking the container of polishing compound, squirt a moderate amount directly on the workpiece in an area the size of your polishing pad [**Photo D**]. Place the foam pad on the compound and start your sander at its highest speed.

Press lightly and polish a workpiece section of about 3 square feet in overlapping circles [**Photo E**]. Go easy at edges and corners. Polish these areas just enough to reach the desired sheen, then stop before you polish through the finish.

Note: *With polyurethane, sanding or polishing too long in one area can cut through the outer topcoat to the layer below and create a ring. If that happens, clean the workpiece thoroughly with mineral spirits, scuff sand it with 320-grit abrasive, and apply a full-strength topcoat. After it cures, sand as before and resume polishing.*

The polish forms a powder as you work and the polishing pad will gradually leave a clear, smooth surface [**Photo F**]. In the reflection of an angled light, check for an even sheen and repeat for any missed spots.

After wiping the surface with a clean, soft cloth, add shine and remove the polishing compound residue by wiping on an automotive cleaner and polish. (See **Sources**.)

SQUIRT POLISH TO FIT YOUR PAD

D

Deposit polish in an area no larger than your pad can cover. Then place the pad on the polish and start the sander. Work a roughly 3-square-foot area until the polish thins and dries.

MORE RESOURCES

FREE VIDEOS

- "Filled-Pore finish" woodmagazine.com/filledporevidt
- "Fix Flaws in Film Finishes" woodmagazine.com/finishfix

RELATED ARTICLES

- "Fill-Pores for an Even Sheen" Issue 181 (December 2007) or at woodmagazine.com/filledpore. $

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Sources

Pore filler. Behlen Pore-O-Pac Grain Filler in mahogany no. B744-1256 (other colors available), $19.95 per quart, Tools for Working Wood, 800-426-4613 or toolsforworkingwood.com.

Polishing compound. Wizards Turbo Cut no. 11044, Wizmar International, 800-356-7223 or wizardsproducts.com ($21 for 32 oz from Above All Wholesalers, 631-471-0318 or aawsales.com).

Cleaner and polish. Wizards Mist-N-Shine no. 1214, Wizmar Intl. ($14.25 for 22 oz from Above All Wholesalers.)

Buffing pad. 9" yellow buffing pad no. 91235-0VGA, $7, Harbor Freight, 805-388-3000 or harborfreight.com.

Electric polisher. DeWalt variable-speed polisher no. DW847 with a 7" backing pad, ($170 from Amazon.com), 800-433-9258 or dewalt.com.

WORK IN OVERLAPPING CIRCLES

E

Use a light touch with your random-orbit sander and keep the pad spinning freely. Overlap each pass with the previous one.

WIPE OFF LOOSE POLISH POWDER

F

Polishing compound dries to a powder you can easily wipe off the surface with a soft cloth, such as an old cotton T-shirt.

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4 tips for safer routing

You've carved out some precious shop time for that long-awaited project, and now you're eager to get the job done. But slow down: Your rush could make you do something rash. One bad move can damage the workpiece—or, even worse, *you*. Follow these four router safety tips, and you won't let haste make waste.

Tip 1: Know when to rout handheld

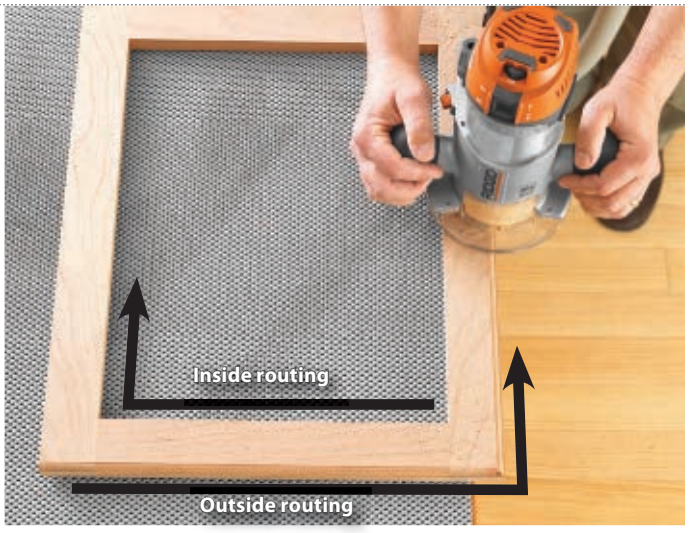
The router table is a great place to machine easy-to-manage, midsize pieces and narrow moldings. With the router fixed into a tabletop, you can focus your attention on the workpiece instead of the tool. And you always should "take it to the table" whenever you work with pieces so small that you wouldn't be able to see or grasp them beneath the base of a handheld router.

But what about oversize tasks, such as rounding over the edges of a dining-room tabletop? That's when you take a handheld router to the workpiece. Perched on the edge of a workpiece, a handheld router can get tippy; but you can counter that. Simply rotate the router so the handles run perpendicular, not parallel, to the workpiece edge (as shown at *right*), and use one hand to exert pressure squarely over the workpiece while merely moving the router with the other.

Tip 2: Don't be afraid to ask for directions

Before routing freehand or on the table, ask yourself which direction everything needs to move. To cut with more control and less chatter, rout so that the bit's cutting edges meet the wood head-on. (In the reverse, a technique known as *climb-cutting*, the cutting edges tend to ride along the workpiece, like wheels on a car, rather than digging in and cutting. This might cause the router to jerk away from you.)

So how do you know which direction is which? In a handheld router, the bit spins clockwise when viewed from above, so move the router counterclockwise when routing outside edges, as shown at *right*. For inside cuts, rout clockwise. When your router is mounted underneath a table, the bit spins counterclockwise, so always feed workpieces from right to left.



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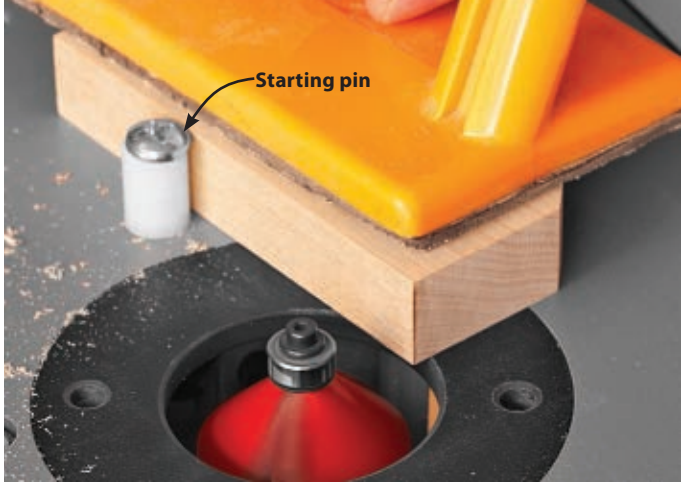
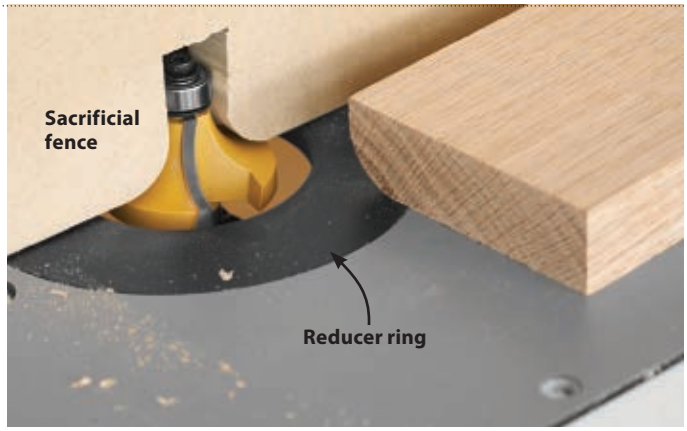


Tip 3: Start with a starting pin

Although you can't typically use a fence when routing irregular shapes on a router table, you still need a way to control the workpiece as you begin your cut. So install a removable starting pin in your router table—the closer to the bit the better—and use it as a fulcrum to ease the workpiece against the whirling cutter, as shown at *right*. After making contact with the bit's guide bearing, you no longer need to brace against the starting pin.

You can make your own pin by cutting the head off a bolt and threading the shaft into a hole tapped into your router table or insert. Or clamp a pointed piece of scrap to your router table to act as a pivot point to start the cut.



Tip 4: Give small pieces big attention

No matter what you're routing, you need to maintain a firm hold on the workpiece while keeping your fingers in the clear. That proves especially difficult, though, with tiny pieces, such as parts for the Bulldozer project on *page 56*. For safer, cleaner cuts, follow these three steps:

First, always use a router table with the smallest reducer ring that fits the bit. Second, close up the bit opening in the fence as much as possible or create a zero-clearance sacrificial fence from scrap stock or MDF, as shown at *right*. Finally, keep a good hold on the workpiece by locking it into a handscrew clamp (*opposite top* photo). It grips small, irregular shapes; it keeps your hands at a safe distance; and its wooden jaws won't cause damage if they contact the router bit.

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Ash: The next Elm or American Chestnut?

An update on the Emerald Ash Borer

HUNGRY LITTLE BUGGERS

Telltale "galleries" left in wood just under the bark by feeding EAB larvae destroy a tree's ability to transport water and nutrients.

Photo courtesy of Mark Guthmiller, Wisconsin Department of Natural Resources

Perhaps as a child you remember city streets lined with huge, gracefully arching elm trees. Or you've been lucky enough to work with an old piece of American Chestnut. Both of those once-common species were devastated by imported fungal diseases. Now another great North American hardwood tree, the ash, is under assault from abroad, although this time it's an insect, the emerald ash borer (EAB), doing the damage.

The beetle was first discovered in the early 2000s in the Flint, Michigan, area, where it likely hopped off a container ship from Asia. The ½"-long EAB begins its cycle of destruction in early- to mid-summer when females lay hundreds of eggs into the furrows of an ash tree's bark. Larvae hatch from those eggs, tunnel under the bark, and feast on the thin cambium layer that serves as the tree's transportation system for nutrients and water. (See photo *above*.) This effectively strangles the tree, and it dies completely in about two years, its wood largely untouched by the invader. The larvae survive in green wood, even firewood from a tree no longer standing.

So far the bug has been detected in the hotspots shown in the map on *page 26*. Estimated to have destroyed tens of millions of trees already, the EAB threatens some 7.5 billion more trees. It attacks all subspecies of *Fraxinus Americanus,* including white, black, blue, green, and pumpkin ash trees.

What's being done

Though few experts believe the EAB can be stopped, many efforts aim to slow its spread. First and foremost, movement of bark-on ash in the infested areas is prohibited. Nevertheless, many unwitting people move firewood around the country, resulting in the growing number of isolated hotspots.

Several federal agencies have gone on the offensive by introducing two wasp species that naturally prey on the EAB. The effect of these wasps has not yet been determined.

While federal and state agencies do their part, what can you do? First, never move any firewood or mulch outside of a quarantine area. If you live within 15 miles of a known EAB infestation and have a few trees you want to protect, you can apply a chemical treatment, such as Bayer Advanced 12 Month Tree & Shrub Insect Control. The ideal time

continued on page 26

EAB larvae, about 1" long

Photo: David Cappaert

As adults the EAB takes on wings and a colorful exterior.

Photo: David Cappaert

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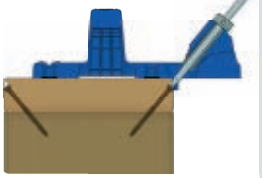

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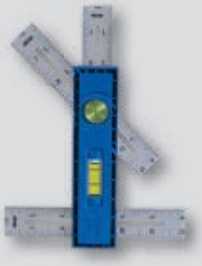

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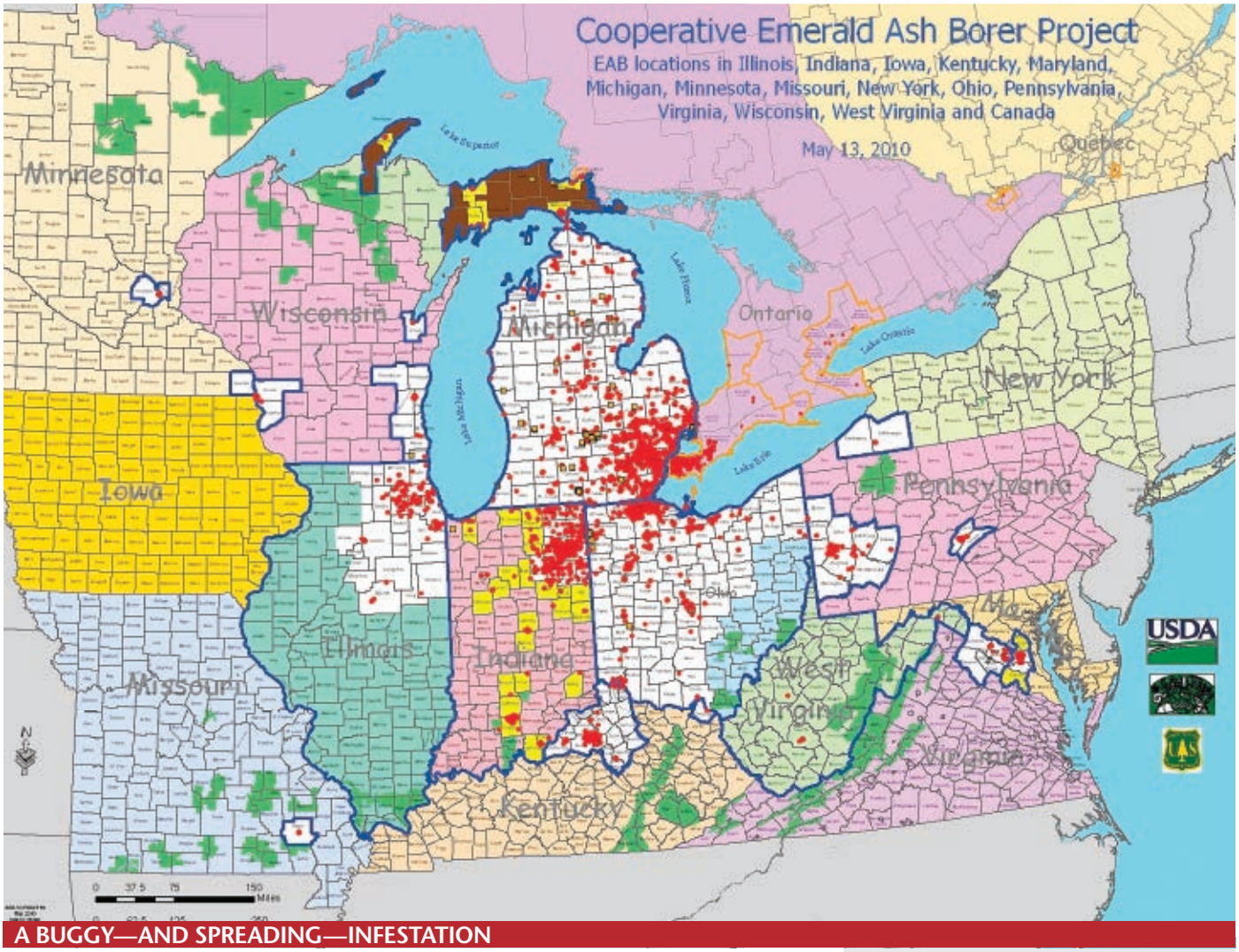

Map courtesy of USDA-APHIS

A BUGGY—AND SPREADING—INFESTATION

Red dots indicate where the EAB has been detected, but that doesn't mean counties without dots do not have the bug. For example, in Michigan early detection efforts centered around Detroit, resulting in many red dots. Now the EAB is presumed to be throughout the state so detection surveys are no longer conducted in lower Michigan. Isolated detections, such as in Missouri and West Virginia, may have resulted from firewood being transported to those areas. Note that federal and state agencies have established their own quarantine areas. To learn more about your local quarantine, contact your state or provincial department of agriculture.

Map Key

- EAB positive
- Site under evaluation (symptoms found in firewood or eradicated)
- Federal EAB quarantine boundaries
- State quarantined-generally infested area
- State quarantine
- State quarantine-other (Mich.)
- National forests
- Canadian EAB regulated areas

to apply is mid-April to mid-May. You simply mix the concentrate in water according to the product label and apply around the base of the tree. One treatment lasts a year and costs about $3–$4 for a tree with an 8"-diameter trunk. You can buy the product at many Home Depot, Lowes, and Wal-Mart stores. If your tree's trunk diameter exceeds 15" call a tree-care service that has a wider variety of treatments at its disposal.

Once a tree dies, cut it down in the winter, when the larvae are "locked" in the tree prior to getting wings. Process the wood into firewood or mulch.

Some sawyers, such as Bruce Horigan of Horigan Urban Forest Products in Skokie, Illinois, are working with the U.S. Department of Agriculture-Animal and Plant Health Inspection Services (USDA-APHIS) to formulate methods to process affected trees into usable lumber. On his sawmill Horigan cuts off the bark and 1" of sapwood, and then sends those slabs to the grinder. He then saws and dries the remaining log cant into lumber.

The future of ash trees

Most experts agree it's just a matter of time before the EAB spreads to all of the indigenous areas where ash trees grow. Unabated, the spread would have happened within perhaps two decades. Because of the measures being taken, the time-frame for complete spread might instead be 50–75 years. So we'll likely have access to reasonably priced ash lumber for the near future; but the mighty tree will never rule our forests in the numbers it does today.

MORE RESOURCES

- To learn more about the EAB, go to emeraldashborer.info. For specific questions related to the EAB call USDA-APHIS at 866-322-4512.

Editor's Note: *Our thanks to Matt Seiler, moderator at woodmagazine.com; Jane Larson with the Wisconsin Department of Agriculture, Trade, and Consumer Protection (DATCP); and Sharon Lucik with the USDA-APHIS for their contributions to this article.*

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Tablesaws on Trial

How much are three fingers worth? $1.5 million, according to a Boston jury in a controversial case.

That buzz you've been hearing lately isn't from using your router without ear plugs. It's woodworkers talking about the guy who won more than a million dollars in a civil lawsuit after getting his hand tangled up in a tablesaw. After the verdict and award were announced, online woodworking forums exploded with outrage.

Why all the hubbub? Because this was the first case to go to trial where attorneys argued that flesh-detecting technology, like that on SawStop tablesaws, could have lessened the injury. After reviewing more than 1,100 pages of trial transcripts, here's what we learned about the case.

The incident

Carlos Osorio, then 25, worked for a small Boston-area company installing and repairing hardwood floors. On April 19, 2005, he was using a Ryobi BTS15 benchtop tablesaw (without its blade guard/splitter) to rip a piece of oak flooring. He turned on the saw and with the blade near full height, and without using the fence, he pushed the flooring toward the blade—a freehand cut.

Less than 1" into the cut, he felt the workpiece get stuck and vibrate, so he pushed harder, felt "the piece of wood kicking up," and his left hand went into the saw blade, nearly amputating one finger and seriously injuring two more. Now the use of those fingers is "severely limited," according to the transcripts.

A bit of background

About 10 years ago, Stephen Gass invented SawStop, a device that detects when flesh touches a turning tablesaw blade, and then blasts a brake pawl (shown *below*) into the teeth of the blade, stopping it cold and leaving, typically, only a nick in the skin.

Gass offered to license his patented technology to tablesaw manufacturers who were intrigued, but wary. Would

SawStop brake pawl

TABLESAWS BY THE NUMBERS:

6–10 Estimated tablesaws in use in the U.S., in millions*

$350 Estimated annual retail sales of tablesaws, in millions*

55,300 Estimated number of medically treated tablesaw injuries in 2001*

$2.1 Estimated cost of treating tablesaw injuries during 2001, in billions*

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More resources online

- Read Carlos Osorio's own description of the accident in excerpts from the trial transcripts at woodmagazine.com/tstrial.
- Offer your opinion on this case in our online discussion groups at woodmagazine.com/forums.
- Bone up on your tablesaw safety at woodmagazine.com/tssafety.

the technology be reliable in the harsh, dusty environment of a woodworking shop, or on jobsites with extreme temps and humidities? How would it hold up over time? Saws would need a complete redesign to accommodate the braking mechanism. And, candidly, some manufacturers thought the inventor wanted too much money. Unable to license his invention, Gass decided to manufacture his own saws.

At about the same time, according to court records, the Power Tool Institute (PTI), an industry coalition made up of competing power tool manufacturers, started its own joint venture into developing a system that would not stop the blade, but instead drop it harmlessly below the tabletop should skin contact be detected.

By 2004, Stephen Gass was selling SawStop saws. At the time of Carlos Osorio's jury trial in February 2010, no saw was yet using the PTI system.

Now, back to the case

Osorio sued One World Technologies, Inc. (OWT, Ryobi's parent company) in U.S. District Court in Boston, saying the BTS15 tablesaw was defectively designed because it didn't include flesh-detection technology. In court, Osorio's attorneys argued that Ryobi executives went as far as signing an agreement with Stephen Gass in 2002. But communications stalled and the contract was never consummated. That contract would have required Ryobi to implement SawStop within two years, meaning it could theoretically have been employed on the saw that injured Carlos Osorio, which was manufactured in 2004.

OWT's defense team argued that, although it might work fine on a contractor-style or cabinet-style saw, activating the brake would likely trash a lightweight, gear-driven benchtop saw like the BTS15. Engineers would have to beef up internal components and make the saw larger, pushing the price of this bottom-dollar saw ($180 at the time) up to $500, putting it—and eventually every benchtop tablesaw—out of the reach of many consumers. Further, OWT's lawyers said, the BTS15 met or exceeded all safety requirements in place when the saw was manufactured, and even on the date of the injury.

Sensible saw safety without science

A tablesaw may seem scary because of that sharp, spinning blade. But even a common tablespoon can seriously injure you if used improperly. Your most important safety device for any tool can't be removed, because it's permanently attached above your neck. Use your noggin and follow these common-sense tablesaw rules:

- **Always** keep the saw top and surrounding area free of offcuts, tools, and clutter that can interfere with the cut.
- **Never** set the blade higher than shown at *top*. The gullet between the teeth should just clear the top of the workpiece.
- **Always** use a blade guard and splitter, unless the nature of the cut makes it physically impossible, such as a partial-depth cut.
- **Never** make a freehand cut. Guide the workpiece with the saw's fence, miter gauge, or a jig.
- **Always** provide good stock support for both the "keeper" and offcut.
- **Never** trap a cutoff between the rip fence and the blade.
- **Never** stand directly in line with the blade, nor put any body part in line with the blade while cutting.
- **Never** force a cut or place your hands within 6" of the moving blade.
- **Always** trust your gut. If a task feels unsafe, it probably is.

The verdict

After deliberating about ten hours, the Boston jury found Carlos Osorio 35 percent negligent in the accident, and OWT 65 percent at fault, and awarded Osorio $1.5 million in damages. (His actual medical expenses at the time of the trial totalled about $384,000.) As we went to press, OWT lawyers were weighing their post-trial options.

The impact on you

Most manufacturers we contacted wouldn't comment on the outcome of this case. But SawStop's Stephen Gass felt vindicated, saying, "The jury held this manufacturer accountable for making an unsafe saw." Gass also told us his company is developing a benchtop tablesaw that he expects to be on the market in about two years. He "hopes the cost will be under $1,000."

So, if this verdict and award holds up on appeal, flesh-detecting technology—whether SawStop, PTI's system, or something else—could become as ordinary as airbags in automobiles. In fact, the Consumer Product Safety Commission (CPSC) has already voted to mandate such safety devices on tablesaws, but the PTI got it to back down to a voluntary standard in light of its joint venture on safety.

And this case appears to be only the tip of the tablesaw-suit iceberg. Our research revealed more than 60 similar cases pending nationwide, including a Chicago-area man who is suing Bosch in Cook County District Court for "collud[ing] with its competitors and others in the power-tool industry to keep [flesh-detecting technology] off the market."

253 Collective number of years of tablesaw use by *WOOD*® editors

0 Number of serious tablesaw injuries to *WOOD* editors

622 Finger "saves" reported to SawStop from 2005 to 2009†

* **Source:** CPSC National Electronic Injury Surveillance System (NEISS) Study, 2001
† **Source:** Stephen Gass, President, SawStop

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Plumb beautiful bookcases

Floors tilt, walls lean and bow, and room corners meet at less-than-square angles. So begin with careful room measurements [**Photo A**] before making plans to fit your combined built-ins within the shortest dimensions.

Next check wall corners for right angles using a framing square. For corners that are out-of-square or off from vertical by more than a couple of degrees, plan to widen by ½" the face-frame stile butting against the sidewalls to compensate. Measure to any obstacles, such as floor registers, cold-air returns, outlets, windows, doors, or a fireplace.

Now work up a design

You're not just fitting built-ins *within* a room, you're fitting them *around* objects such as windows, doors, and fireplaces. Start with a critical dimension, such as the width of a window. For a window, measure its width (including the trim) and add enough space on both sides to accept your curtains or drapes. Otherwise, leave a 2–4" gap to help built-ins slide into place. Mark this gap on the wall on both sides of the window. Measure between marks for the window-seat length, in this case 48" to work around a 42"-wide window.

Now measure from your marks beside the window to the adjacent wall. Check several locations for the shortest distance and subtract ½" from that dimension on each side of the window to determine the width of cabinets flanking the window seat. (Oversize stiles or moldings will eliminate this gap.)

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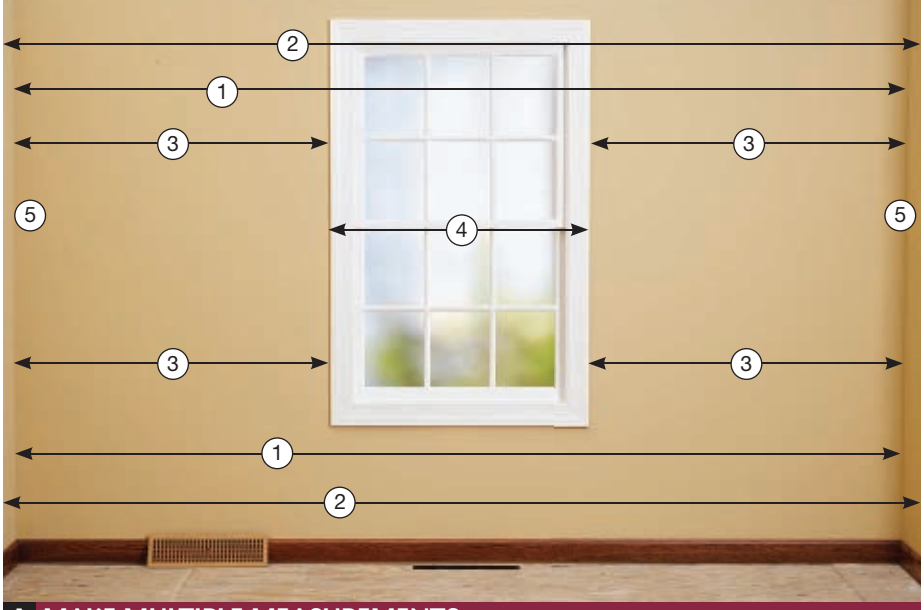

A MAKE MULTIPLE MEASUREMENTS

Measure between walls at the ceiling and floor in two places, ① and ②. Then measure between walls and a window ③, and the window width ④. Finally check the corner angles ⑤ for square.

Materials List

Use this list to record the part sizes for your built-ins. Part quantities reflect the number of parts required to assemble one built-in of each type. Parts such as the side frames and moldings vary by installation and are not included.

Window seat		FINISHED SIZE					
Part		T	W	L	Matl.	Qty.	Total
A	sides	¾"	"	"	Ply	2	
B	bottom	¾"	"	"	Ply	1	
C	stiles	½"	3"	"	H	2	
D	rails	½"	3"	"	H	2	
E	center stiles	½"	2"	"	H	2	
F	front panel	¼"	"	"	Ply	1	
G	panel trim	¼"	¾"	"	H	1	
H	top back	¾"	8"	"	H	1	
I	top sides	¾"	3¼"	"	H	2	
J	lid	¾"	"	"	Ply	1	
K	top trim	¾"	1½"	"	H	1	
L	back	¼"	"	"	Ply	1	

Materials key: H–hardwood of your choice, Ply–hardwood veneer plywood to match hardwood.

If your built-in will fit underneath a window, measure from the floor to the bottom of the trim (22" in this case) to determine the maximum height of a window seat. We made this window seat 19" high to leave a gap below the window frame for a seat cushion or pillows. Because window seats are made for stretching out, they can be taller than the standard 16¾" height of most chairs. For deciding other dimensions, consider these standards:

- Typical base cabinets measure 24" deep, but you can shrink this some to conserve floor space. (The ones shown measure 20½" deep.)
- Make upper shelves at least 12" deep. Add depth to suit larger contents.
- The maximum comfortable shelf height for upper bookcases is 68".
- To avoid shelves that bow, consider the size and weight of objects they'll hold before deciding their length (and the bookcase width). Use the chart *below right* for an idea of what to expect from different materials. For bookcases wider than the 42½" ones shown, reinforce the shelves to prevent sagging. (We used ¾×1⅜" solid-wood edging.)

Both bookcases and the window seat rest on a ladder-frame base designed to be 17½" deep—3" shallower than the depth of the lower cabinet and window seat—to allow for a toekick. The ladder frame makes it easier to level your built-ins and slide them into position.

We'll show how to modify the ladder frame two ways to accommodate either a baseboard- or floor-mounted air vent. To channel air from a baseboard register, split the ladder frame to create a channel above the floor. The ladder-frame base shown measures 4¼" tall, ½" higher than the baseboard molding.

As you're making plans, include details such as lighting, decorative molding, and trim elements. Trim goes beyond being decorative. The hardwood side frames on portions of the bookcases cover screw holes in the plywood carcase not hidden by walls or adjoining cases.

To divide this project into manageable chunks, first build the window seat [**Drawing 1**] on *page 32* to fit your window width. Build bookcases as separate lower cabinets and upper shelves, and then the ladder-frame base.

First make a window seat

For the window-seat carcase, subtract ¾" (the ½"-thick face frame plus a ¼"-thick front panel) from the finished window-seat depth for the width of the ¾"-thick plywood carcase sides (A) and bottom (B). Then rip those parts to width.

The window-seat face frame measures 1" longer on each end than the plywood case, so subtract 1" from your finished window-seat length for the length of the plywood carcase, and cut the bottom to length. For the carcase sides, subtract the ladder-frame height plus ¾" for the top from the finished seat height and crosscut the case sides to this length.

Cut and assemble the face frame (C/D/E) to allow a ½" overhang on the bottom and both sides. Finally, from ¼"-thick plywood, rip the front panel (F) 1½" narrower than the length of the carcase sides, and crosscut to the length of the bottom panel. Finish-sand the front panel and frame.

Before assembling the window seat, check whether you need to channel air from a floor register through the seat.

Shelf Material Selection Guide

The shelf material, edging, and shelf length determine whether or how much a shelf will sag. Even if you're not storing a 64-lb set of encyclopedias, err on the side of caution.

Shelving Material	Shelf Length				
	24"	32"	36"	42"	48"
	Amount of Sag Under a 64-lb Load				
¾" oak-veneer plywood/ ¾×1¼" oak edge	0"	3/64"	5/64"	7/64"	7/64"
¾" Baltic birch plywood/ ¾×1¼" poplar edge	0"	0"	0"	0"	6/64"
¾" solid oak	1/64"	1/64"	3/64"	9/64"	20/64"
¾" solid pine	1/64"	5/64"	9/64"	15/64"	20/64"

Numbers in red indicate sagging greater than a visually acceptable 2/64" per running foot. (Results are in 64ths of an inch for easy comparison.) Shelves without edges measure 11" wide; edging widens them to 12¼".

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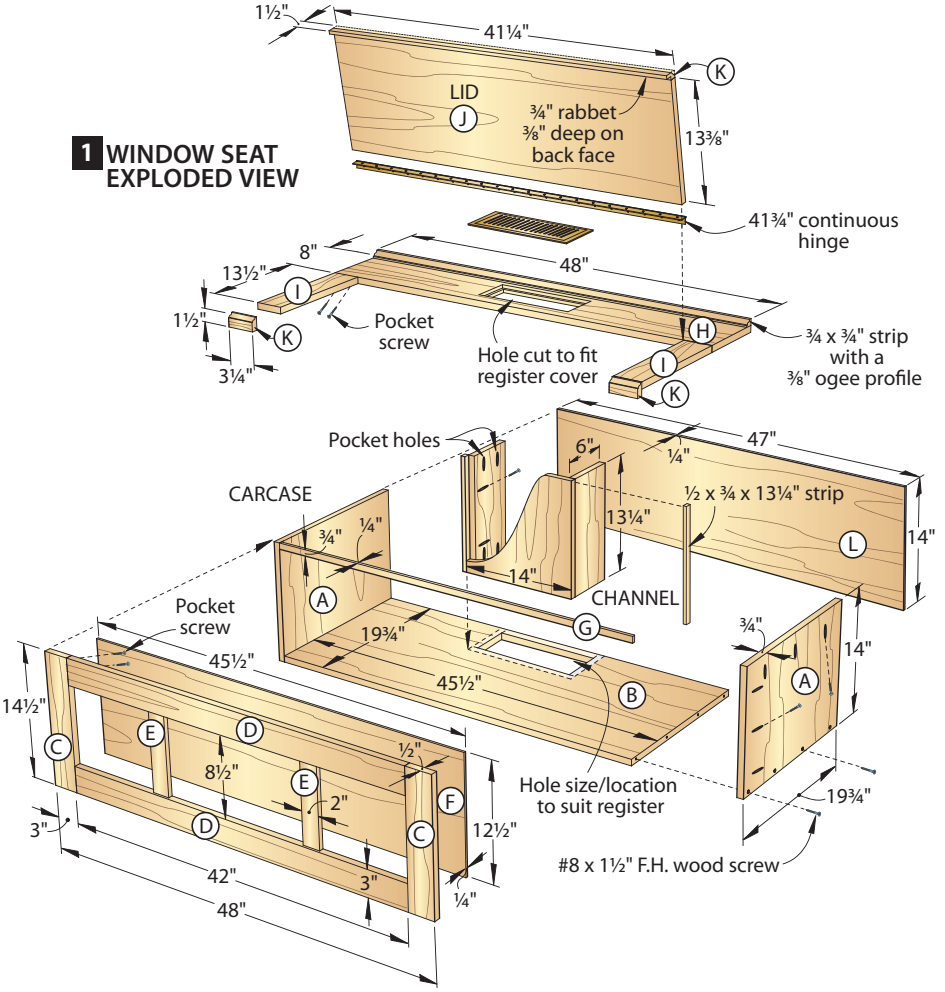
Double-faced tape the hinge with the barrel centered between the window-seat lid and the top back and screw the hinge in place.



(See "Move air through the seat or a gap in the base" *below* for how to do this.)

To assemble the case, drill pocket holes in the sides [**Drawing 1**] and screw the sides to the bottom. Then screw the front panel and face frame to the sides. **Note:** *Use fine-thread pocket-hole screws to avoid splitting the narrow hardwood frame parts.* Add a trim piece (G) to hide the plywood panel edge.

To make the window-seat top frame and lid, first cut an 8"-wide top back (H) that's 1" longer than the case. Then cut two 3¼"-wide top sides (I) long enough to reach from the top back to the front of the face frame. Drill and screw the top sides to the top back and screw that assembly to the case sides. If the window-seat sides will be exposed, build a frame from ½×3" hardwood to hide the pocket holes and fill the face-frame overhang.

From ¾" plywood, cut the window seat lid (J) ¼" shorter than the opening between the top sides and wide enough for the front edge to rest flush with the face-frame surface. Cut and rout a top trim piece (K) blank 1" longer than the face frame. From that, cut two top-trim pieces for the ends of the top sides and glue them in place. Rabbet the rest of the blank and cut it to the lid length. Glue and clamp the trim to the seat lid. Now attach the lid to the top frame with a continuous hinge [**Photo B**]. Finally cut a back (L) to fit over the edges of the bottom and sides. Then screw it to the case and top frame.

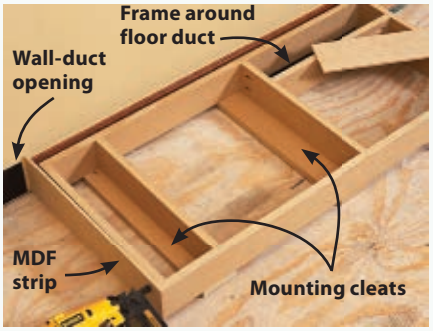
Move air through the seat or a gap in the base

If you have an air register where the window seat will rest, you'll need to channel air into the room one of two ways. To route air through the window seat, first mark the register location on the window-seat bottom.

Next cut and screw together a channel sized on its inside to surround the opening plus 1" on both sides and the front. Position the channel on the window-seat bottom with the side edges flush with the back edge of the bottom. Mark around the inside edges of the channel and in from the back edge of the bottom as needed. Drill ¼" holes at the corners and jigsaw between the holes to create the opening, as shown *above right*. Then drill pocket holes and screw the channel to the carcase bottom.

When you're ready to attach the window-seat top, jigsaw an opening in the top back (H) centered above the channel and ½" narrower and shorter than a hardwood grille you can buy at most home centers in the hardwood flooring section. Then rabbet the opening to accept the grille.

For baseboard registers or floor registers beneath a bookcase, redirect air out through a gap in the ladder-frame base, as shown *above right*.



After leveling and anchoring both parts of the base to the floor and with each other, seal the sides of the chase with ¼"-thick MDF strips that reach from the wall beside the register opening to the front of the base. (You'll cover the ends of these strips with base trim.) The addition of the cabinet will complete the chase. Just add a metal or wood register to cover the opening.

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Next, the lower cabinets

Subtract 1" from the finished cabinet width determined earlier to find the lower-cabinet carcase width. Cut the carcase sides (M) and bottom (N) to size as you did for the window seat. Next cut two stretchers (O) and a fixed shelf (P) the same length as the bottom panel. Rip the fixed shelf width 4" less than the bottom. Glue and clamp the hardwood trim (Q) to the front plywood edge. Then drill and screw the lower-cabinet sides to the bottom, shelf, and top-mounting cleats [**Drawing 2**, **Photo C**].

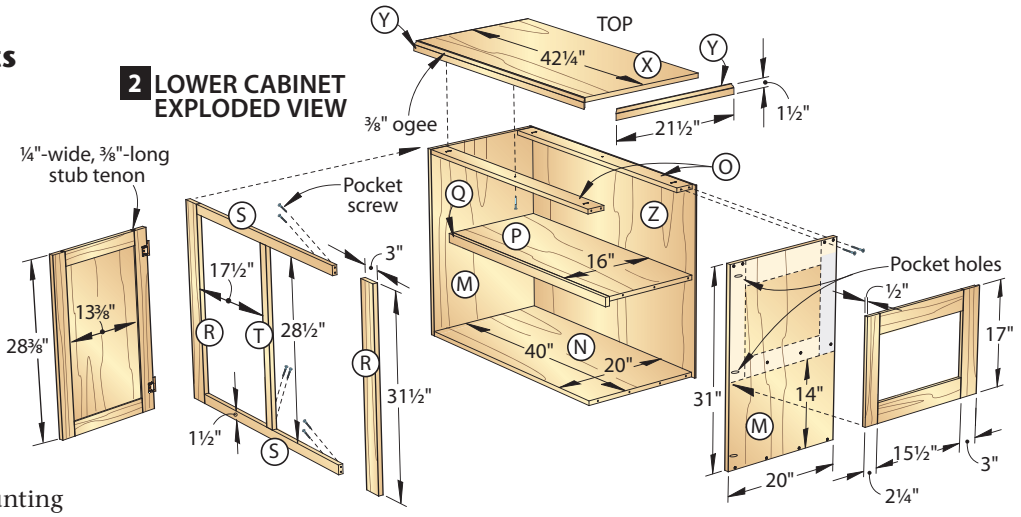
Size the lower-cabinet face frame (R/S/T) to overlap ½" on both case sides and at the bottom. To attach the frame to the case, drill pocket holes in the carcase sides where they'll be concealed by trim pieces or an adjoining built-in—the window seat in this case. Then clamp and screw the frame to the case.

If you need a full or partial frame for one or both sides [**Photo D**], add an extra ½" to the width of the stile closest to the wall and cut a ¾" rabbet ¼" deep on the inside face of this piece. Scribe and cope the rabbeted stiles to fit the wall.

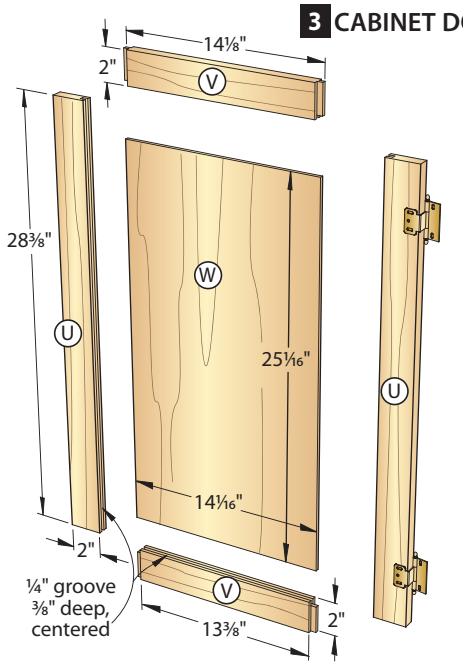
Measure the face-frame opening and cut door stiles (U) ⅛" shorter than the opening height [**Drawing 3**]. Cut the rails (V) ⅝" oversize for two ⅜" stub tenons [**Drawing 3a**] minus two 1/16" reveals. Cut centered grooves on one edge of each rail and stile. Cut panels (W) to fit the frame and assemble the doors. (For more about these doors, see **More Resources**.)

Finally, from plywood and ¾" hardwood edging, build a lower-cabinet top (X/Y) [**Drawing 2**] that hangs 1" over the front frame and each side frame. Then rout the edges. Measure the carcase, cut a back (Z) to fit, and screw it in place.

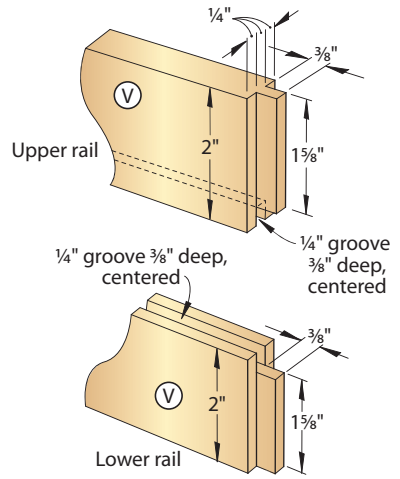
2 LOWER CABINET EXPLODED VIEW



3 CABINET DOOR



3a DOOR-RAIL DETAILS

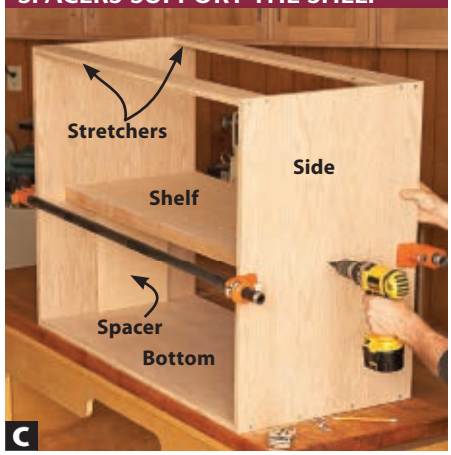


Lower cabinet and top

Part		FINISHED SIZE T	W	L	Matl.	Qty.	Total
M	sides	¾"	"	"	Ply	2	
N	bottom	¾"	"	"	Ply	1	
O	stretchers	¾"	4"	"	Ply	2	
P	shelf	¾"	"	"	Ply	1	
Q	shelf trim	¾"	1⅜"	"	H	1	
R	stiles	¾"	3"	"	H	2	
S	rails	¾"	1½"	"	H	2	
T	center stile	¾"	1½"	"	H	1	
U	door stiles	¾"	2"	"	H	4	
V	door rails	¾"	2"	"	H	4	
W	door panels	¼"	"	"	Ply	2	
X	top	¾"	"	"	Ply	1	
Y	top trim	¾"	1½"	"	H	1	
Z	back	¼"	"	"	Ply	1	

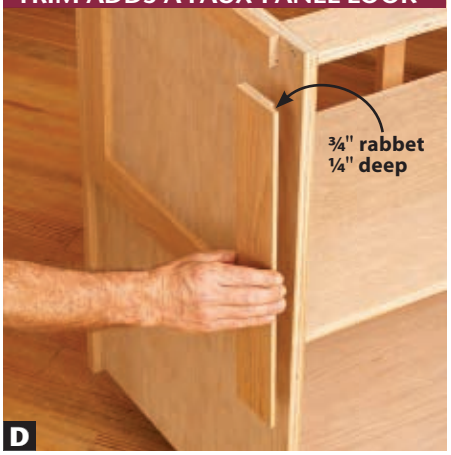
Materials key: H–hardwood of your choice, Ply–hardwood veneer plywood to match hardwood.

SPACERS SUPPORT THE SHELF



Insert spacers to help center the shelf and hold it in position while you drill and screw it to the lower-case sides.

TRIM ADDS A FAUX-PANEL LOOK



Trim on the upper half of the cabinet portion of this bookcase hides shelf and stretcher screws. The window seat hides the lower half.

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Add open shelving on top

The upper-shelf carcase goes together much like the lower-cabinet carcase. Rip the carcase sides (AA), top (BB), and fixed shelf (CC) 11½" wide. Cut the sides to length to fit your room height. Then cut the top and fixed shelf to the same length as the lower-cabinet bottom (N). Drill shelf-pin holes in both sides. (See **More Resources** for information on drilling shelf-pin holes.)

Next rip the adjustable shelf (DD) ⅞" narrower than the sides and 3/16" shorter than the fixed shelf. Glue on the front trim (EE) and sand it flush with the plywood. Drill and screw the sides to the top and fixed shelf [**Drawing 4**].

Size the upper-shelf face frame (FF/GG/HH) so that the stiles overlap ½" on both case sides but are flush with the top and bottom of the sides. (The extra overlap helps you scribe and cut the stiles to fit a wall or mate with a side frame.) Drill pocket holes and screw the top rail (GG) to the face-frame sides (FF). To accurately align a middle rail (HH) with the fixed shelf (CC), see the **Shop Tip** *above right*.

Next cut, rout, and screw the hardwood trim pieces (II) to the sides just below the top and at the bottom. (You'll use these later to help attach the back.)

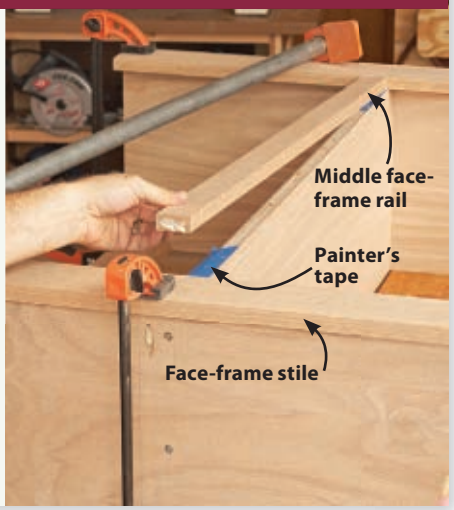
For the visible sides of the upper shelf, add a ½"-thick face frame to the sides to hide the screw holes. Use the same widths as for the lower-cabinet side frames and rabbet the 3" side-frame stiles where shown [**Drawing 4**].

Finally cut a back (JJ) to fit the upper shelf. Finish-sand the window seat, base cabinet, upper shelves, top, and backs. Stain and apply three coats of clear finish. Afterward screw the back to the shelf at the top, sides, and bottom.

SHOP TIP

Add a middle rail to hide a fixed-shelf edge

To position a middle face-frame rail (HH) accurately along a shelf, first apply painter's tape to the plywood carcase edges and shelf where the shelf meets the sides. Clamp the face frame to the carcase and drill pocket holes at each end of the rail. Glue and clamp the rail between the face-frame stiles with the rail edge flush with the top of the shelf. After the glue dries, remove the frame and tape, and drive pocket-hole screws to reinforce the glue joints. Screw the face frame to the carcase and sand the middle-rail top edge flush with the shelf.

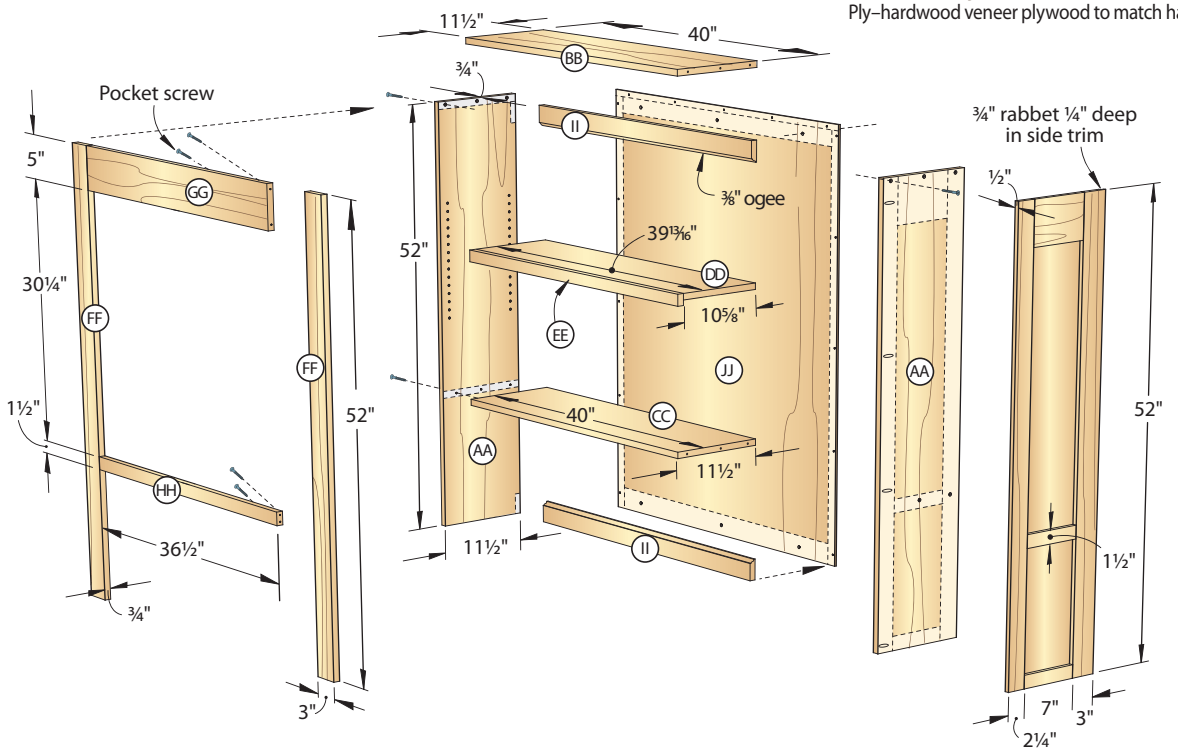


Upper shelf

Part		FINISHED SIZE T	W	L	Matl.	Qty.	Total
AA	sides	¾"	11½"	"	Ply	2	
BB	top	¾"	11½"	"	Ply	1	
CC	fixed shelf	¾"	11½"	"	Ply	1	
DD	adjustable shelf	¾"	"	"	Ply	1	
EE	adjustable-shelf trim	¾"	1⅜"	"	H	1	
FF	face-frame stiles	¾"	3"	"	H	2	
GG	top face-frame rail	¾"	5"	"	H	1	
HH	middle face-frame rail	¾"	1½"	"	H	1	
II	back trim	¾"	1⅜"	"	H	2	
JJ	back	¼"	"	"	Ply	1	

Materials key: H–hardwood of your choice, Ply–hardwood veneer plywood to match hardwood.

4 UPPER SHELF EXPLODED VIEW



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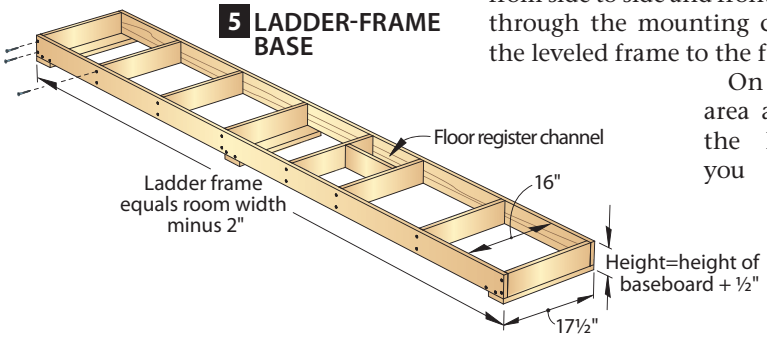
Make and install the base

From ¾" MDF, cut blanks for the ladder-frame base ½" wider than the room's baseboard width (4¼" in this case). For wall-to-wall built-ins, cut the long front and back strips of the ladder frame 2" shorter than the distance between the room baseboards [**Drawing 5**]. If a built-in has one side open to the room, cut these strips an additional 3" shorter.

5 LADDER-FRAME BASE

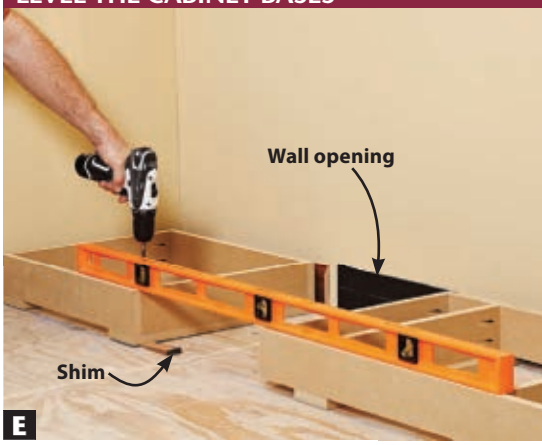


Then cut cross braces to length for a 3" cabinet overhang in front and a 1" gap between the back of the completed frame and the wall. Screw the cross braces to both long strips. Cut mounting cleats to the frame width and screw them to the long strips and cross braces.

Lay the ladder frame on the floor with 1" gaps between the ends and back and the walls. Then shim the frame level from side to side and front to back. Screw through the mounting cleats to fasten the leveled frame to the floor [**Photo E**].

On the toekick area at the front of the ladder frame, you can nail on baseboard to match the rest of the room, or use trim cut from ¼"-thick plywood and stained to match the cabinets.

LEVEL THE CABINET BASES



For a divided ladder frame, shim the sections level from front to back, side to side, and with each other. Then screw the frame to the floor.

Install the window seat and cabinets

Place the window seat on the leveled ladder frame and measure to center under the window. Then check that the window seat evenly overhangs the ladder frame in front from one side to the other, adding shims to the back as needed. Press the back of the window seat against the wall and screw it in place [**Photo F**]. Later, you can add quarter-round molding to hide any small gaps between the window seat and the wall. Before adding additional built-ins, trim the excess shims flush with the window-seat sides using a sharp utility knife.

Next apply painter's tape to the entire back stile of a lower cabinet. Temporarily position the cabinet on the base with its face frame parallel to the base and the face-frame stile ½" proud of the window-seat frame. With a compass, scribe the taped back stile [**Photo G**] where it will touch the wall. Jigsaw the stile and sand to the scribed line [**Photo H**]. Then repeat this for the remaining lower cabinets.

Reinstall the lower cabinets and clamp them together. Drill and screw through the cabinet side and into the top frame of the window seat [**Photo I**]. For a cabinet side facing a wall, add shims between the wall and carcase to keep the side from bowing. Drill and screw the cabinet to the wall at the studs.

Now scribe and cut the tops to follow the shape of the front and side walls. Check that each top overhangs equal distances on the front and side, and drill and screw the tops to the cabinets.

MOUNT THE WINDOW SEAT

Marked painter's tape shows stud locations where you'll drive mounting screws through the window-seat back and into the wall.

SET A COMPASS FOR SCRIBING

The difference between the lower cabinet and window-seat depth (inset) equals what you'll remove from the lower-cabinet stile.

SAW ALONG THE SCRIBE LINE

By angling the jigsaw cut slightly, it's easier to sand or plane the stile to your scribe line. Tape protects the wood finish.

DRILL FOR CONNECTING SCREWS

Pull the bookshelf cabinet and window seat tightly together using clamps before drilling pilot holes. Doors will help hide the screws.

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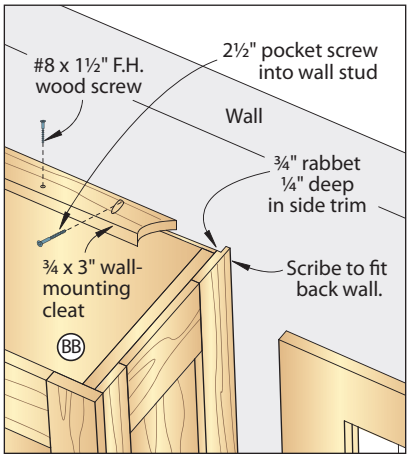
Top cabinets with shelves

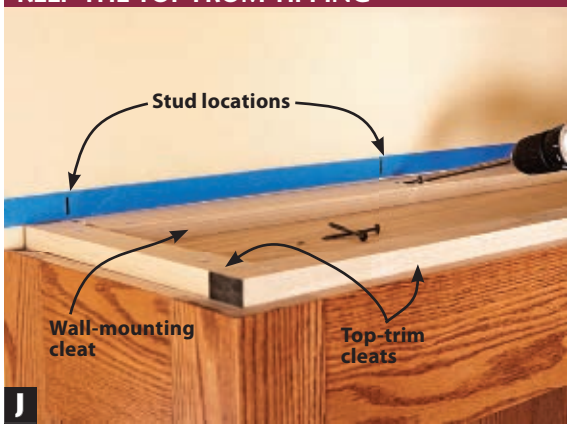
Place the upper shelf assembly on the lower-cabinet top with the shelf face frame parallel to the front edge of the top, and the back side-trim stiles about ½" from the wall. Tape, scribe, and jigsaw the side-trim stiles to follow your walls as you did on the lower cabinets.

Before mounting the shelf, drill and screw a wall-mounting cleat and trim cleats to the shelf top [**Drawings 6** and **7**]. Add pocket holes where you'll screw into wall studs. Rest the shelf on the lower-cabinet top and screw the shelf to the lower-case top from underneath. Screw the shelf to the back at the studs using the wall-mounting cleat [**Photo J**].

6 WALL-MOUNTING CLEAT


#8 x 1½" F.H. wood screw
2½" pocket screw into wall stud
Wall
¾" rabbet ¼" deep in side trim
¾ x 3" wall-mounting cleat
Scribe to fit back wall.
BB

KEEP THE TOP FROM TIPPING



By screwing into the wall-mounting cleats to stabilize the upper shelves, you avoid using screws visible from inside the shelves.

Build up a crowning touch

To anchor the crown molding, cut and rout a ¾×3" filler strip to fit between the tops of the bookshelves. Rout a ⅜"-ogee profile on it where shown [**Drawing 7**]. Next cut and rout crown-cap blanks to reach around and between your bookcases. Finish-sand the filler strip and crown-cap blanks to 220 grit and finish them to match the built-ins. Then screw the filler strip to the wall studs.

Miter-cut a crown cap to reach between the bookshelves over the window seat and screw it to the filler strip. Measure and miter-cut crown caps for the shelf tops, and drive pocket screws into the trim cleats [**Photo K**].

Finish-sand the crown moldings to 220 grit and stain them. Miter-cut crown molding to fit between the bookcases and nail it to the crown cap and filler strip [**Photo L**]. Then cut and nail the remaining crown [**Drawing 7**].

Mount doors in the lower cabinets using no-mortise hinges. Then install the heat-duct grilles in the window seat or toekick and the loose shelves in the bookcases. Now you're ready to step back and admire this great new addition to your home.

ADD CAPS FOR CROWN MOLDING

Clamps hold the crown caps flush while you fasten them to the top-trim cleats. If necessary, add brads to the outside corners.

BEGIN ADDING CROWN MOLDING

Cut crown molding to fit between the bookcases so that the upper edge of the miters matches the crown-cap miters.

MORE RESOURCES

FREE VIDEOS

- "Drilling Shelf-Support Holes" woodmagazine.com/shelfholes
- "Cutting Crown Molding" woodmagazine.com/crownmldg

RELATED ARTICLES

- "The Shelf Maker's Complete Guide" Issue 154 (March 2004) or at woodstore.net. (Type in "shelf maker.") $
- "Simple Frame-and-Panel Doors in 30 Minutes" Issue 182 (March 2008) or at woodstore.net. (Type in "simple doors.") $

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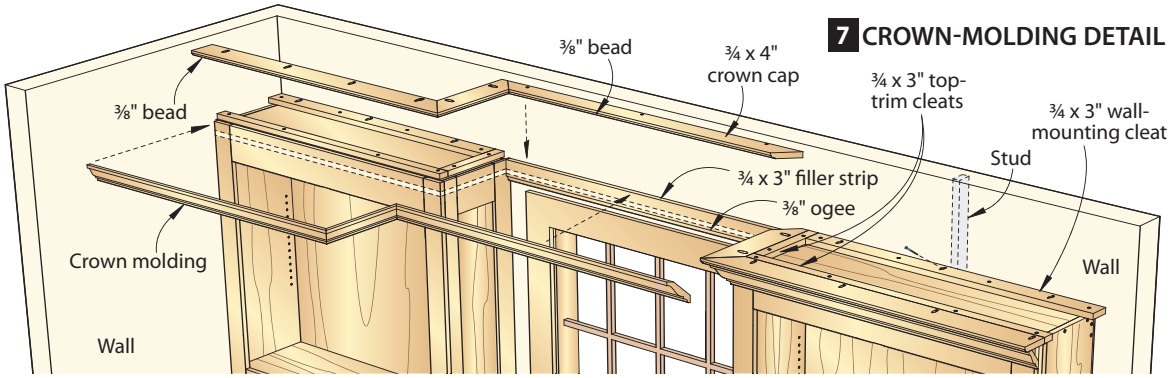
7 CROWN-MOLDING DETAIL



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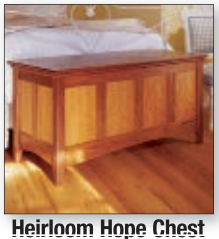

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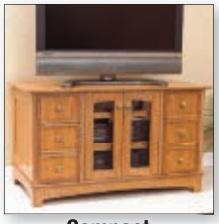

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Turning Pen$ into Ca$h

When it comes to financing his education, this 13-year-old has the write stuff.

Aspiring heart surgeons need steady hands, a delicate touch, mental focus—and a whole lot of money for school. Some quality time at the lathe helps Alex Lesniak address each of those needs as he plans for a career in medicine.

Alex discovered woodturning a month before his 11th birthday during a trip to a woodworking show near his home in Raleigh, North Carolina. Fascinated by the lathe from the moment he saw one demonstrated at the show, Alex begged his father, George, for one of his own. "You know how kids can be," George says, "so I challenged him. He had to sell me on the idea of getting a lathe." After that, they both had to convince Alex's mom, Cathleen. "I was kind of skeptical at first," she says. "But then Alex said 'Mom, I can turn pens and sell them and make money for college.' " That moment of entrepeneurial insight sealed the deal.

A pen turned from Tru-Stone, a mix of crushed semiprecious stones and resin, has contrasting "veins" for a marbled look.

Aluminum gutter flashing laminated to walnut enhances the over-and-under weave of a Celtic knot in a pen of figured maple.

"Pens for College" begins

Soon, Alex brought home his brand-new, variable-speed midi-lathe. He watched videos and visited Web sites to learn all he could about turning. Within two months, he was crafting his first pens.

A trip to the North Carolina Woodworker's Club picnic sparked initial demand for Alex's work. Although intended to be just a "show and tell" event, he ended up selling several pens. Then, at a contest sponsored by a woodworking store in Raleigh, Alex won first, second, *and* Best-of-Show for his age group…and sold more pens. Repeated inquiries prompted Cathleen to put together a Web site (pensforcollege.com) showcasing Alex's work. A new business was underway.

Mixed media

Alex turns a variety of materials including resins, acrylic, Tru-stone (top pen *above*), and all types of domestic and exotic hardwoods and burls.

One signature Alex Lesniak detail is the Celtic knot (bottom pen, *above*). He first saw the technique online. With some experimentation, he elevated it from a simple inlay of a contrasting wood to an eye-catching feature with delicate metal accents. (Learn how to add a Celtic knot to your turnings on *page 76*.)

The education fund grows

During the non-holiday season, Alex works about 10 hours a week in his father's shop turning "stock" pens (*upper right*) to sell on his Web site and to fill orders. Now, as he enters 8th grade, he's gearing up for full weekends of turning to meet holiday demand.

With hundreds of pens already sold, most in the $75+ range, Alex's college fund is off to a strong start. If he achieves his career goal, every time he fills out a medical chart, he'll be holding a reminder of how he got there.

Produced by **Craig Ruegsegger**
Alex photos by **Robin Cotten**
Pen photos by **George Lesniak**

STOCK PENS OF EVERY STYLE

From catalogs and Web sites, Alex orders kits with the metal pen parts. These pens, turned from big-leaf maple, show a sample of styles.

KNOW A YOUNG WOODWORKER?

We want to hear about other youngsters doing cool things with wood. Send an e-mail to woodmail@woodmagazine.com or write to *WOOD*® magazine, 1716 Locust LS221, Des Moines, IA 50309.

MORE RESOURCES

FREE VIDEO

- Watch Alex's self-produced video on making a Celtic knot, "The Homework Ultimatum," at woodmagazine.com/homework.

Building a great finish takes time

Achieving the deep, lustrous sheen on a wood pen can require up to four hours. Alex begins by sanding the barrel to 800 grit. With the lathe spinning at about 1,100 rpm, he applies the first coat of his finish, thin cyanoacrylate (CA) glue, with a paper towel, then sprays on a CA accelerator to quickly cure the finish.

Quick Tip! Use tape as a finger pad. Alex wears nitrile gloves and wraps several layers of painter's tape around his index finger, as shown at *right*. As CA bleeding through the paper towel builds up on the tape, he simply peels off a layer to reveal a fresh surface. The tape also insulates his finger from heat buildup.

After three or four coats of CA, Alex steps up the speed to 2,600 rpm and sands lightly with 400-grit sandpaper to reveal low spots in the finish. After filling them with CA and sanding again, he wet-sands with MicroMesh abrasive sheets working up to 12,000 grit. Then he buffs with the No. 1 grade of Novus polish, moves on to Meguiar's Plastx polish, and finally a coat of Renaissance wax. The result is a durable, glass-like finish.

Sources: Find Meguiar's Plastx polish and Novus polish at car-care stores and on these Web sites: meguiars.com, novuspolish.com; Find MicroMesh abrasives and Renaissance wax at Woodcraft, woodcraft.com, 800-225-1153.

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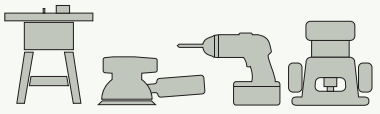
BASIC-BUILT™
GREAT PROJECTS MADE SIMPLE.

Easy and Elegant Hall Table

Beautify your home with this stylish piece built using fuss-free joinery and easy-to-find materials.

WHAT YOU'LL NEED



- **Materials:** 16 board feet of ¾" cherry and a half-sheet of ¾" cherry plywood.

PROJECT HIGHLIGHTS

- Overall dimensions: 48" long × 14" deep × 31¾" high.
- Cut consistent half-laps using a router and jig.
- Create a mortise-and-tenon look that's easier to make than the real thing.

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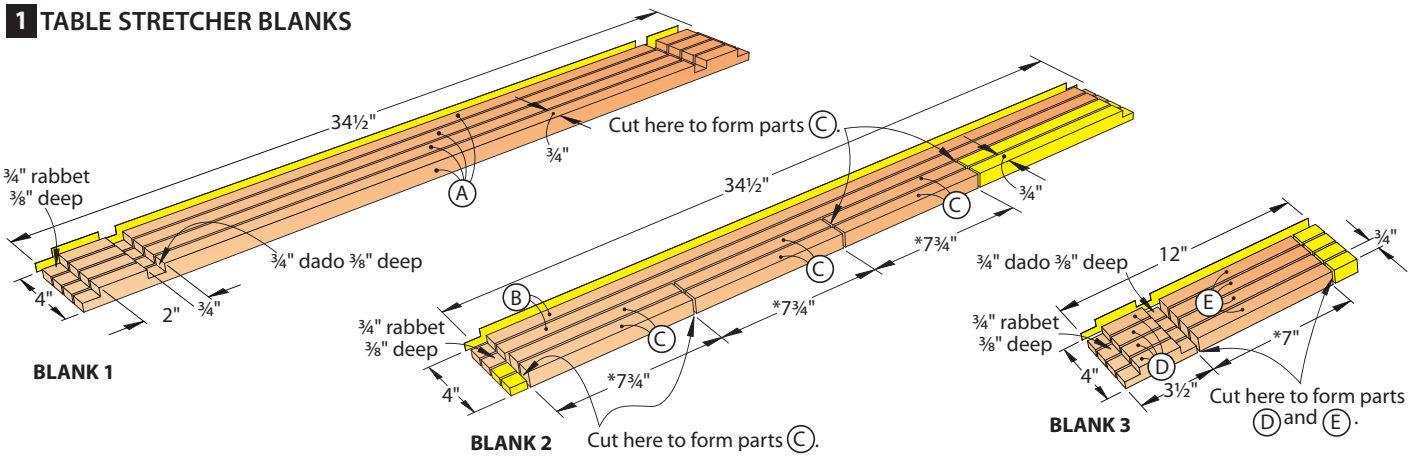
1 TABLE STRETCHER BLANKS



Note: *Initially cut oversize, see instructions.
Yellow indicates waste

Those may look like pegged mortise-and-tenon joints on the legs of this table, but we'll let you in on a little secret: You can make these joints using only basic woodworking skills, screws, and the foolproof jig shown on *page 22*.

Start with stretchers and shelves

1 Cut a 4×34½" blank (blank 1) for the upper stretchers (A); a 4×34½" blank (blank 2) for the lower stretchers (B) and six end stretchers (C); and a 4×12" blank (blank 3) for the stiles (D) and shelf trim (E). (See the **Cutting Diagram** on *page 44*.) ***Quick Tip: Rout many parts with one pass.*** To save time and add accuracy, cut rabbets and dadoes on blanks before cutting the blanks into individual parts.

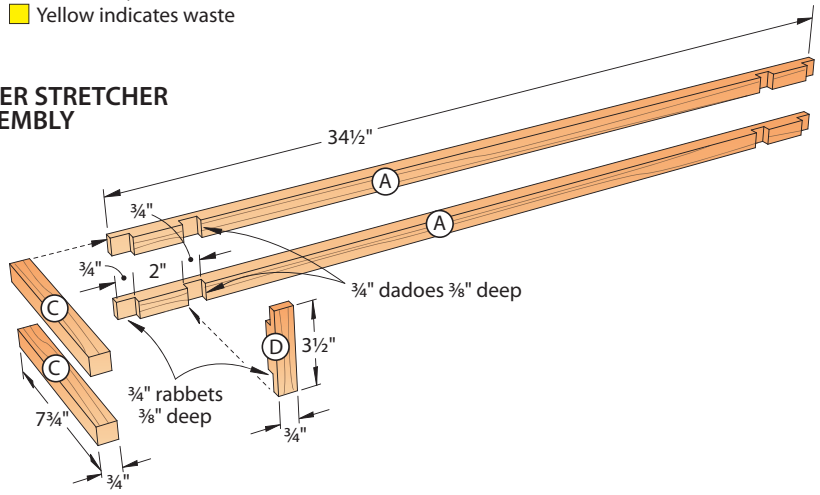
2 Make the half-lap routing jig shown on *page 22*. Using it and a ½" straight bit in your router, rabbet each end of blanks 1 and 2 and one end of blank 3 [**Drawing 1**]. Then rout the dadoes in blanks 1 and 3.

3 Rip blank 1 to make four upper stretchers (A) [**Materials List**, *page 44*]. From blank 2, rip two lower stretchers (B) and the two strips from which you'll later cut the end stretchers (C). Rip blank 3 into four ¾"-wide strips. From each strip, create stiles (D) by crosscutting them beside the dadoed end so that the dado becomes a ¾"-wide and ⅜"-deep rabbet. Set aside the rest of the strips from blank 3 for the shelf trim (E).

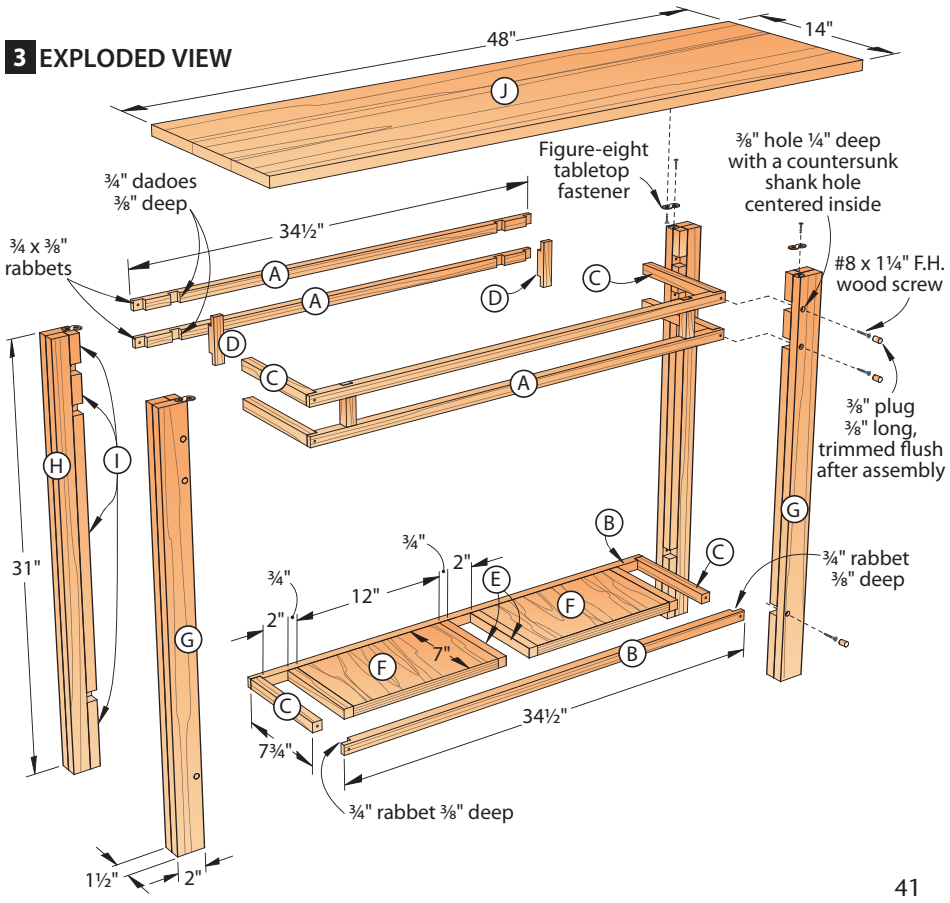
4 Glue and clamp a pair of upper stretchers (A) to a pair of stiles (D) [**Drawings 2** and **3**]. Repeat for the other set of upper stretchers and stiles. Then set aside both assemblies.

5 Cut two shelves (F) to width and ½" oversize in length. From strips cut from blank 3, cut the shelf trim (E) a hair less than ½" oversize in length. Glue the shelf trim centered on the edges of

2 UPPER STRETCHER ASSEMBLY



3 EXPLODED VIEW



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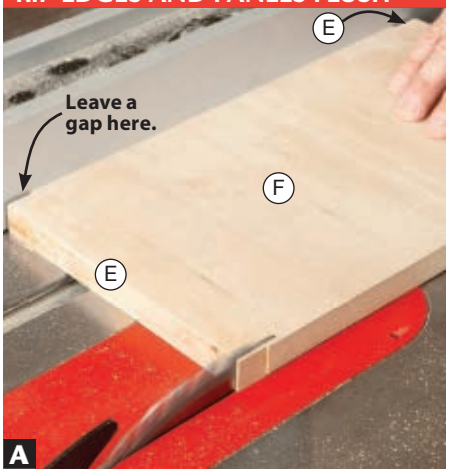
RIP EDGES AND PANELS FLUSH

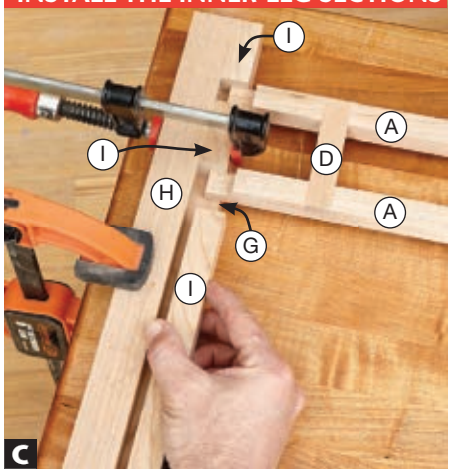


Because the shelf trim (E) doesn't extend to the end of the shelf (F), you can cut the shelf assembly to length with parallel ends.

TRAP GLUE SQUEEZE-OUT

A ⅛"-deep kerf traps squeeze-out that will interfere with attaching fillers (I) to the outer (G) and inner (H) legs.

INSTALL THE INNER-LEG SECTIONS



Glue and clamp the filler (I) pieces one by one to fit around the upper (A) stretchers for tight joints later.

both shelves. Set the rip fence just close enough to the blade to cut the shelf-trim assembly (E/F) even on one end [**Photo A**]. Then reset the fence to trim the shelf assemblies to final length.

Build mortises into the legs

1 Rip the outer legs (G) 1/16" wider and ½" longer than shown [**Materials List**, **Drawing 4**]. Rip the inner legs (H) to width and ½" longer than shown. Rip the filler blanks (I) 1/16" wider than shown. Then cut a ⅛"-deep glue-relief kerf in the inner leg [**Drawing 5**].

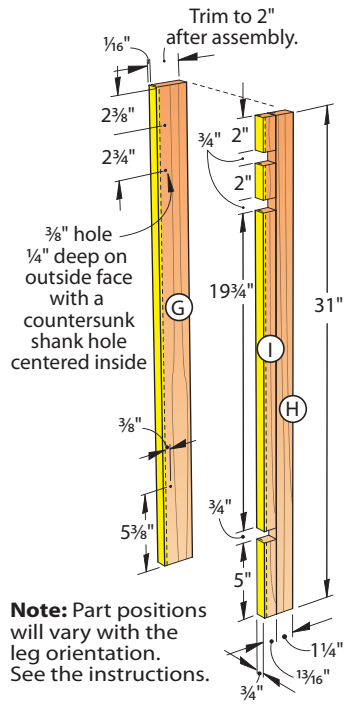
2 Glue and clamp an inner leg (H) to an outer leg (G) with the ends and one edge flush [**Photo B**]. Scrape off glue squeeze-out before it dries. Repeat for the other three legs. After the glue dries, cut the legs to length. **Note:** *Label each leg with its position on the finished table. You'll add filler pieces to make mirrored legs at each end of the table.*

3 ***Quick Tip: Keep grain the same.*** Use one filler (I) blank for each leg and mark one outside face. Then orient the marks facing the same direction for consistent grain and color along the leg. Cut a 2" piece from each filler (I). Glue and clamp one of these to the top end of each leg (G/H) where shown [**Drawing 4**].

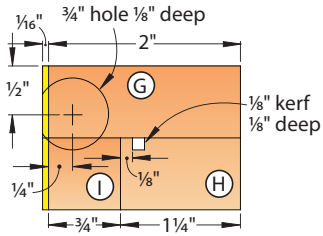
4 From a filler (I) blank, cut a piece to fit between the upper stretchers (A). Hold an upper-stretcher assembly (A/D) in position on the leg (G/H/I). Glue and clamp the filler to the leg as shown [**Photo C**], and remove the upper-stretcher assembly. After the glue dries, cut a 19¾"-long piece from a filler. Insert the upper-stretcher assembly again to position the filler, and glue and clamp it in place. Repeat for the other three legs.

5 Near the bottom of a leg (G/H/I), use a lower stretcher (B) as a spacer and temporarily clamp the last filler (I) piece in place. Mark and cut the filler to length [**Photo D**]. Glue and clamp the filler to the leg with the ends flush. Repeat steps 4 and 5 for the other three legs, then rip each leg to width [**Photo E**].

4 LEG ASSEMBLY



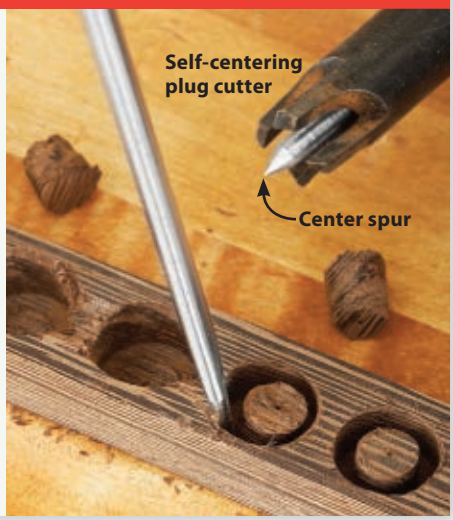
5 LEG (TOP VIEW)



SHOP TIP

Drill plugs without a drill press

Most plug cutters require a drill press to hold the bit steady as it cuts. In a handheld drill, their cutting prongs would catch on the wood and skitter across the surface. But the ⅜" tapered plug cutter shown here (see **Sources**, *page 44*) eliminates the need for a drill press. A center spur steadies the bit as its cutting edges enter the wood, but retracts as you push. After cutting plugs, pry them loose from the bottom of the hole using a screwdriver. In addition to the ⅜" cutter shown, you can also buy self-centering cutters to make 5/16" and 7/16" plugs.



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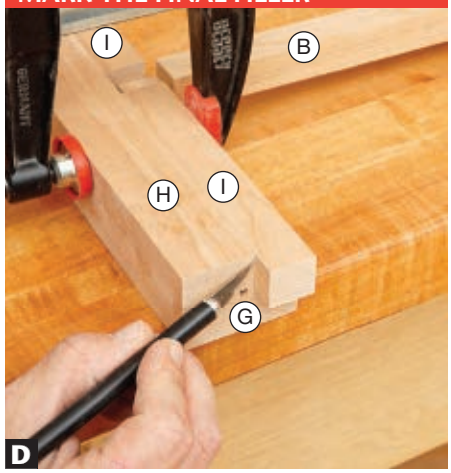
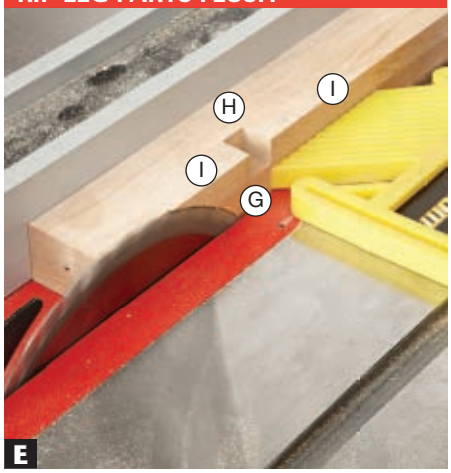
MARK THE FINAL FILLER



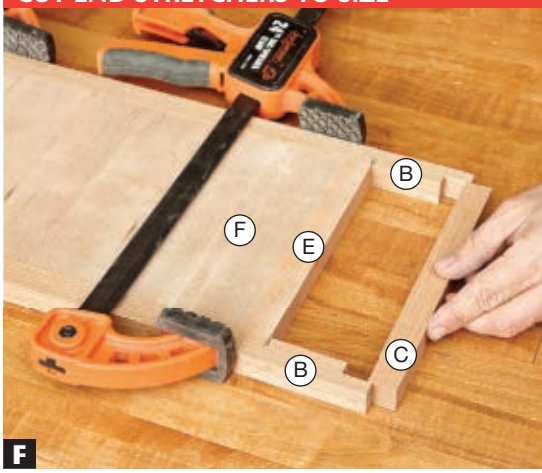
With a lower stretcher (B) on the outer leg (G), butt the filler (I) blank against the stretcher and score its length.

RIP LEG PARTS FLUSH



Ripping the leg (G/H/I) to width leaves the oversize outer leg (G) and fillers (I) flush with each other.

CUT END STRETCHERS TO SIZE



The distance between the lower-stretcher (B) rabbets determines the length of all six end stretchers (C).

Get this table on its legs

1 Glue and clamp two lower stretchers (B) to the shelf panels (E/F) [**Drawing 3**]. Trim the rabbets from the remaining strips cut from blank 2 [**Drawing 1**] and cut six end stretchers (C) to fit between the lower-stretcher rabbets. Glue and clamp two end stretchers to the lower-stretcher rabbets [**Photo F**].

2 Glue and clamp an end stretcher (C) onto each upper-stretcher (A) rabbet and check for square [**Photo G**].

3 In each leg (G/H/I), drill three ⅜" counterbores ¼" deep with centered countersunk shank holes [**Drawings 3** and **4**]. Holes should emerge centered in the gaps between the fillers (I).

4 Clamp a leg (G/H/I) to the upper-stretcher assembly (A/C/D), and drill pilot holes into the stretcher assembly [**Photo H**]. Glue and screw the leg to the stretcher assembly. In the same manner, attach the lower-stretcher frame (B/C/E/F) and the remaining legs.

You're nearly to the top

1 Make a blank for the top (J) by edge-gluing ¾"-thick stock about 1" longer than shown [**Drawing 3**]. After the glue dries overnight, trim the top to size and sand it flat.

2 Mark the top of each leg (G, H, I) for the figure-8 fastener you'll later use to attach the top [**Drawing 5**]. Use a ¾" Forstner bit to counterbore each leg equal to the thickness of a figure-8 fastener [**Photo I**]. At the center of each counterbore, drill a pilot hole.

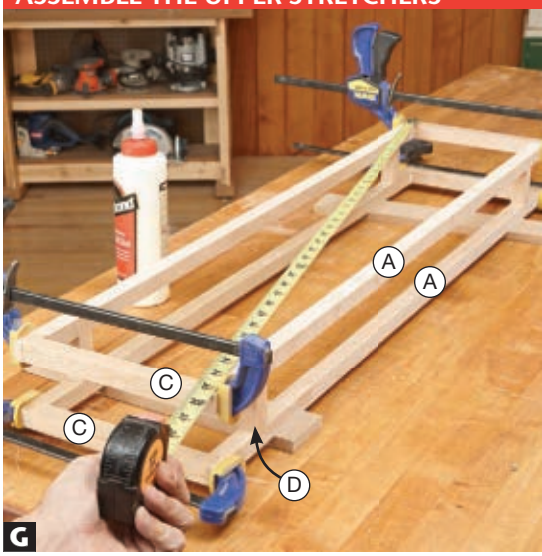
3 Make 12 plugs, as shown in the **Shop Tip** *opposite*, from scrap. (We used ⅝"-thick wenge. For alternatives, see the **Shop Tip** at *right*.) Then pry the plugs loose with a screwdriver.

4 Glue and tap the plugs into the counterbores on the legs (G/H/I). After the glue dries, saw the plugs off close to the face of the legs [**Photo J**]. Then hand-sand the plugs flush with the legs using 120-grit sandpaper wrapped around a flat sanding block.

Quick Tip: Hand-sand to eliminate plug bumps. A random-orbit sander works faster than hand-sanding, but the flexible pad can leave a slight bump or round-over on the plugs. Follow up any power sanding by hand-sanding the plugs using a flat block and the highest grit you used on your power sander.

5 Sand the top and base to 220 grit and ease the edges. Also, sand a slight chamfer on the bottoms of the legs to keep them from snagging carpets and rugs. Apply a coat of boiled linseed oil and allow it to dry. Then lightly sand

ASSEMBLE THE UPPER STRETCHERS



After you glue and clamp end stretchers (C) to the upper stretchers (A), check for square by measuring diagonally between corners.

SHOP TIP

Get creative with plugs

Whether you make your own or buy them, plugs can do more than just hide screws. To add a 3-D detail, use ⅜" end-grain button plugs like the one shown at *top*. (See **Sources** on *page 44*.) These also hide minor tear-out around the hole.

For a plug you'll cut flush with the wood surface, choose a wood species that contrasts or blends with the surrounding wood. Store-bought oak tapered plugs provide a slight color contrast with the cherry in this project, while wenge or walnut creates greater contrast.

Install contrasting plugs with the plug grain 90 degrees to the grain of the leg for added contrast with the surrounding wood. For a matching plug, orient the plug with the grain for better blending.

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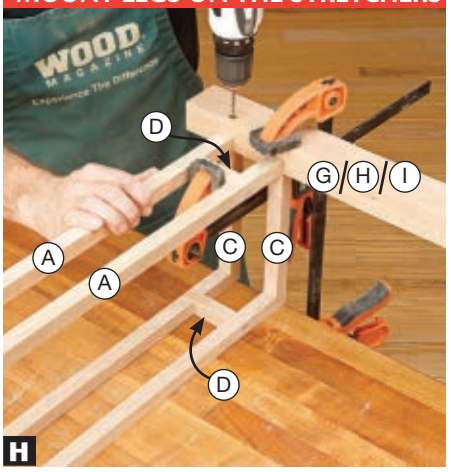
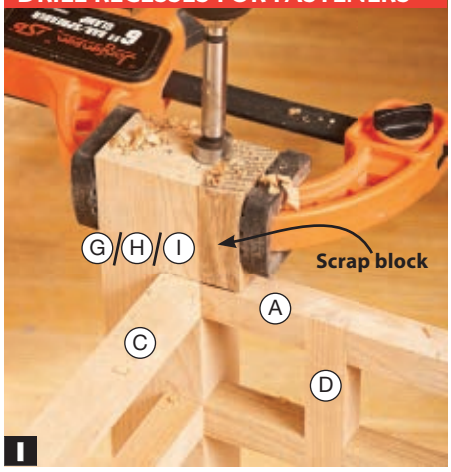
MOUNT LEGS ON THE STRETCHERS



H

Use the countersunk shank holes in the leg (G/H/I) to position pilot holes in the upper-stretcher assembly (A/C/D).

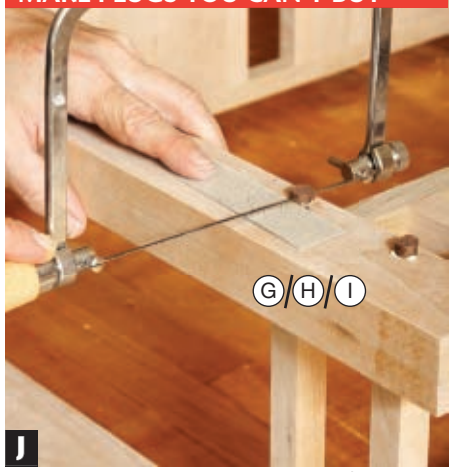
DRILL RECESSES FOR FASTENERS



I

Clamp a scrap block to the leg (G/H/I) to prevent tear-out while drilling over the edge of the leg.

MAKE PLUGS YOU CAN'T BUY



J

To avoid marring the leg (G/H/I) surface, hold a scrap of cardboard beside each plug before sawing it nearly flush.

with a 320-grit sponge, remove the dust with a vacuum and soft cloth, and apply a second coat of oil. **Safety note:** *Oil-soaked rags can spontaneously combust when wadded up and discarded. Instead, first lay them flat to dry.*

6 Screw figure-8 tabletop fasteners to the top of each leg and lay the top (J) upside down on your workbench. Center the base on the top and drill pilot holes into the top for each figure-8 fastener. Then screw the base to the top. Now move your new table to a hallway where it will greet your guests.

Written by **Bob Wilson** with **Jeff Mertz**
Project design: **Kevin Boyle**
Illustrations: **Roxanne LeMoine; Lorna Johnson**

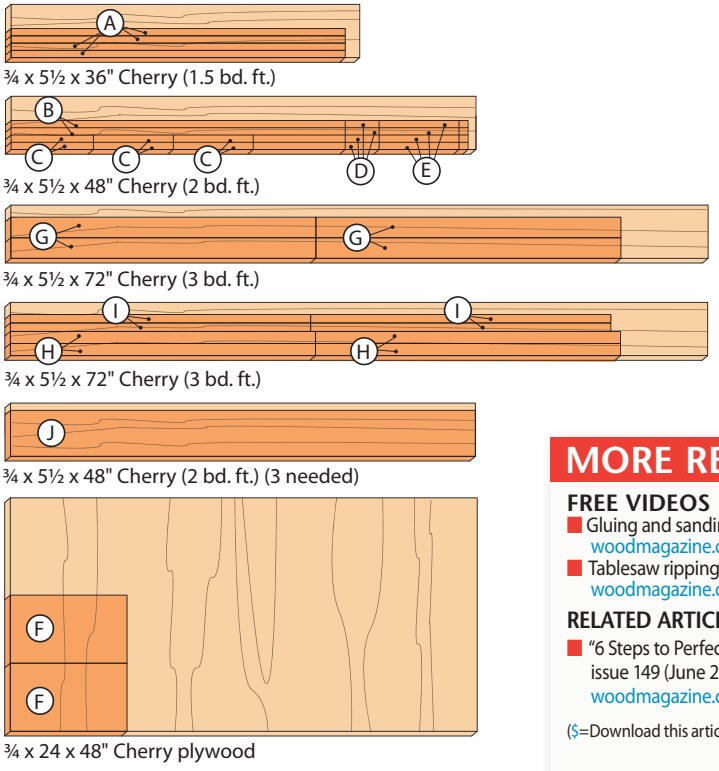
Materials List

Part		FINISHED SIZE T	W	L	Matl.	Qty.
A*	upper stretchers	¾"	¾"	34½"	C	4
B*	lower stretchers	¾"	¾"	34½"	C	2
C*	end stretchers	¾"	¾"	7¾"	C	6
D*	stiles	¾"	¾"	3½"	C	4
E*	shelf trim	¾"	¾"	7"	C	4
F*	shelves	¾"	12"	7"	CP	2
G*	outer legs	¾"	2"	31"	C	4
H*	inner legs	¾"	1¼"	31"	C	4
I*	fillers	¾"	¾"	31"	C	4
J*	top	¾"	14"	48"	EC	1

*Parts initially cut oversize. See the instructions.

Materials key: C–cherry, CP–cherry plywood, EC–edge-glued cherry.
Supplies: #8×1¼" flathead wood screws (8), figure-8 tabletop fasteners (4).
Bits: ½" straight router bit, ¾" Forstner bit.

Cutting Diagram



Sources

Self-centering plug cutter: ⅜" plug cutter no. 31115, $18, Rockler, 800-279-4441, rockler.com.
Plugs: ⅜" oak button plugs no. 20503, $4 for a package of 50, and ⅜" oak plugs no. 20842, $4 for a package of 50, Rockler, 800-279-4441, rockler.com. Also available at many home centers.

MORE RESOURCES

FREE VIDEOS

- Gluing and sanding a flat panel, woodmagazine.com/panels.
- Tablesaw ripping fundamentals, woodmagazine.com/tsripping.

RELATED ARTICLE

- "6 Steps to Perfect Plugs" issue 149 (June 2003) woodmagazine.com/woodplugs. $

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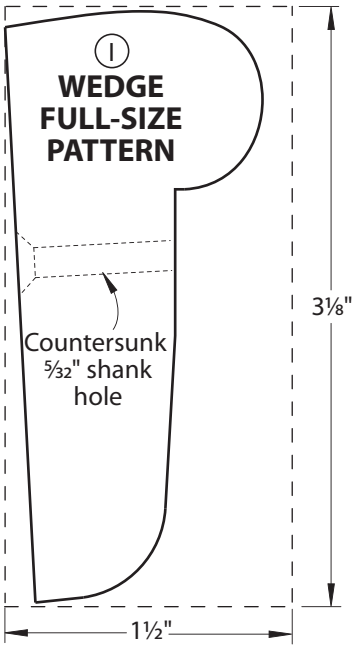

Better Homes and Gardens®

WOOD® PATTERNS®

September 2010 *Issue 199*

Dear Reader: As a service to you, we've included full-size patterns on this insert for irregular-shaped and intricate project parts. You can machine all other project parts using the Materials List and the drawings accompanying the project you're building.

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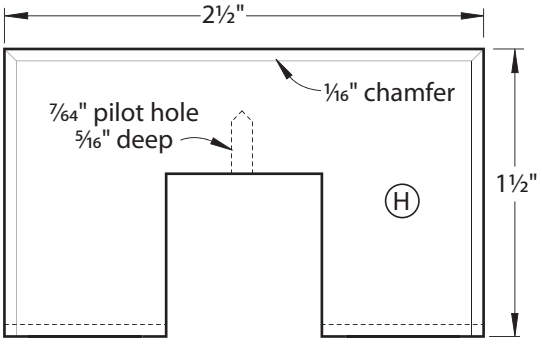
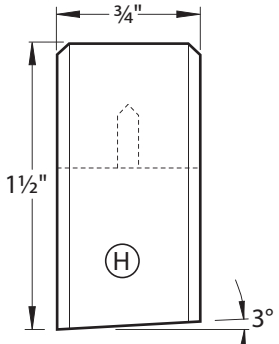


FALSE TENON
FULL-SIZE PATTERN TOP VIEW



FALSE TENON
FULL-SIZE PATTERN
SIDE VIEW

Tapered Display Tower

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Bulldozer
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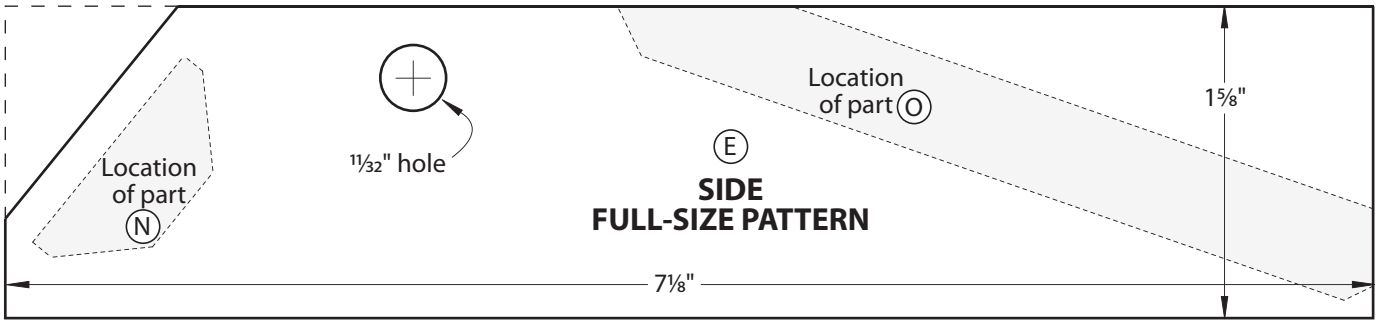
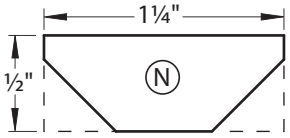
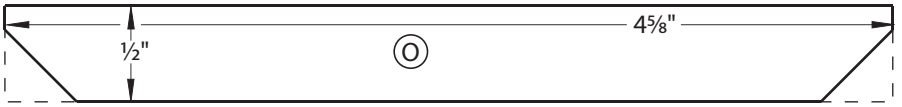
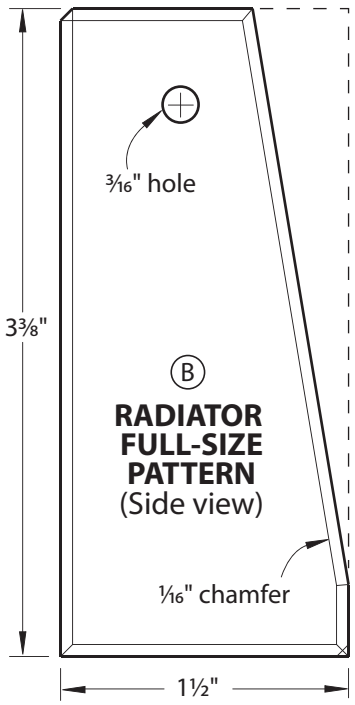


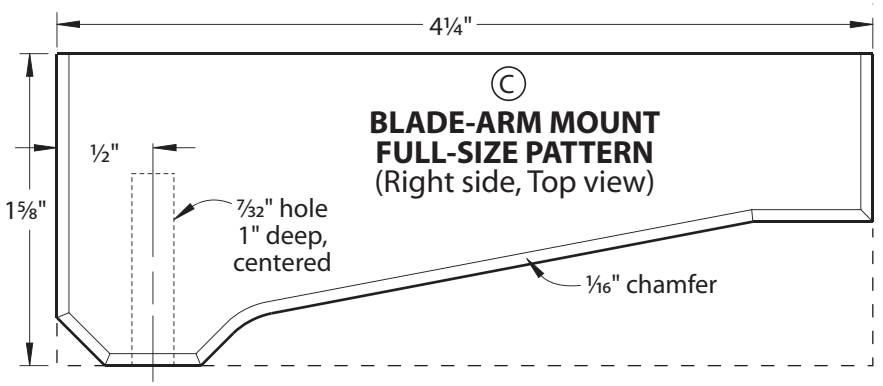


BACK TRACK
FULL-SIZE PATTERN



TOP TRACK
FULL-SIZE PATTERN





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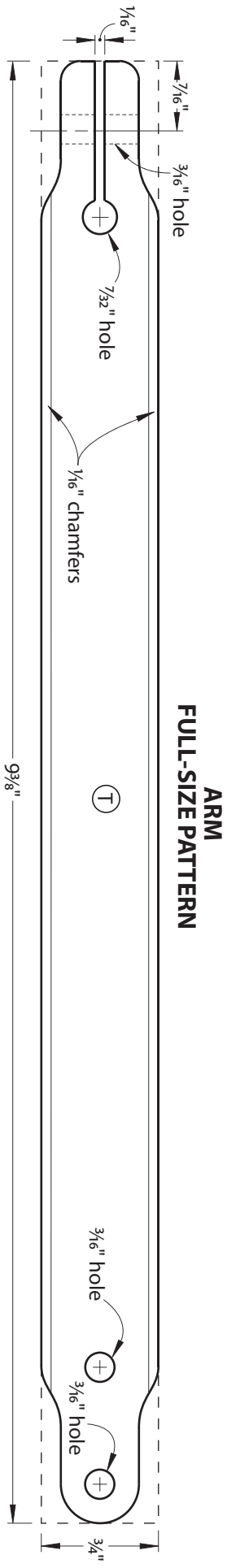
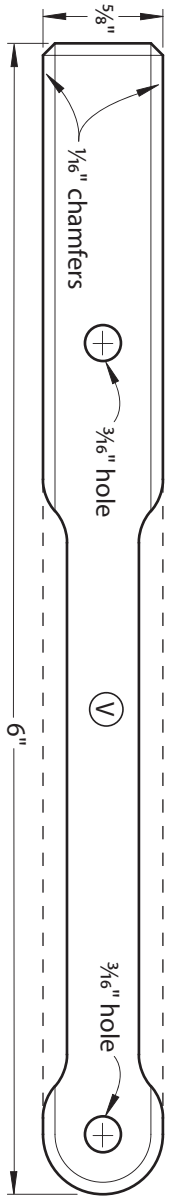
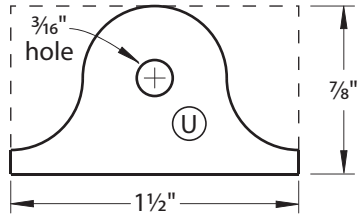


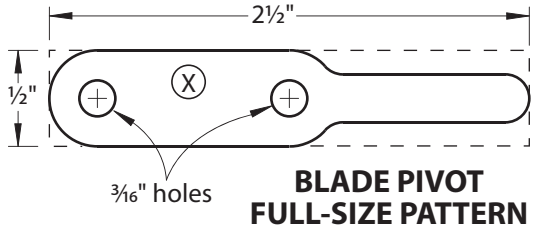
ARM
FULL-SIZE PATTERN



LIFT
FULL-SIZE PATTERN



BLADE BRACKET
FULL-SIZE PATTERN



BLADE PIVOT
FULL-SIZE PATTERN

Bulldozer
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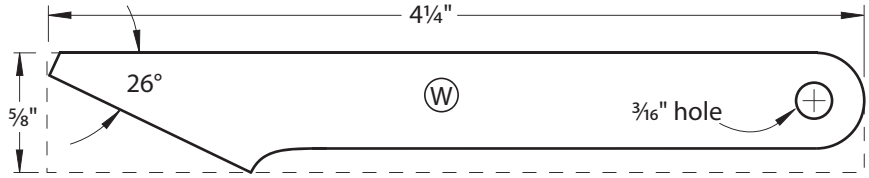
BRACE
FULL-SIZE PATTERN



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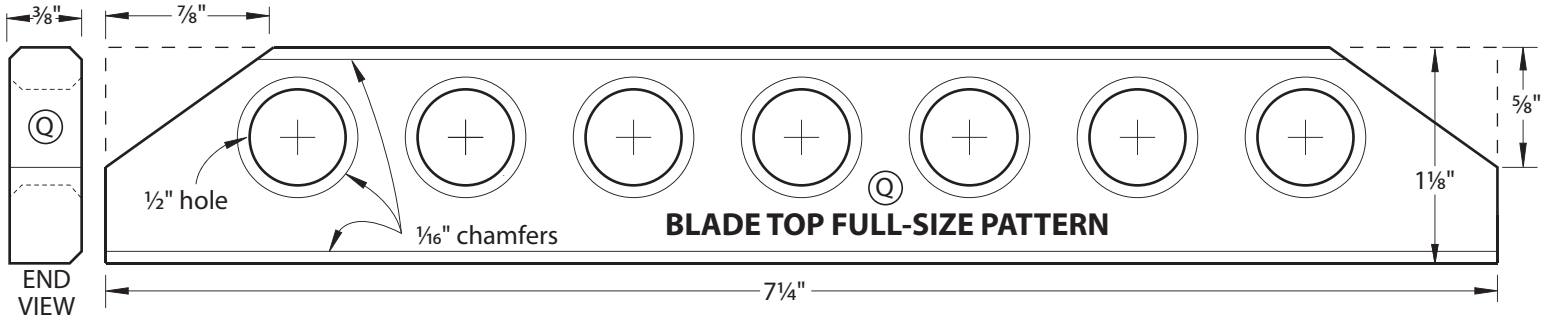

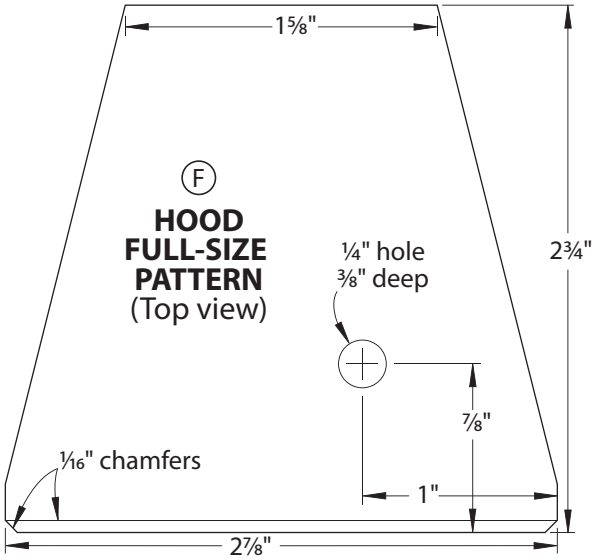

Sanding Center
Page 62

Bulldozer
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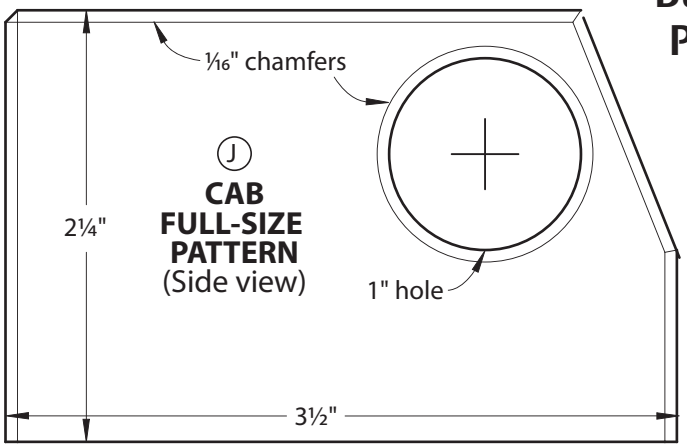

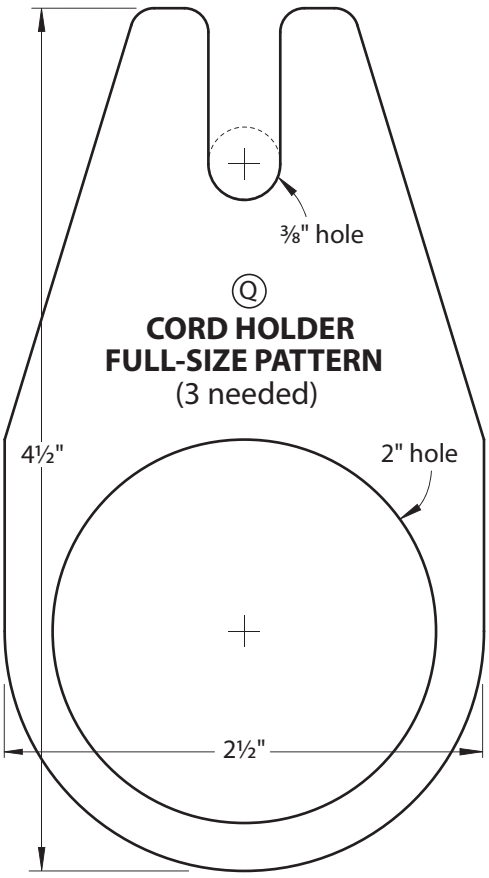

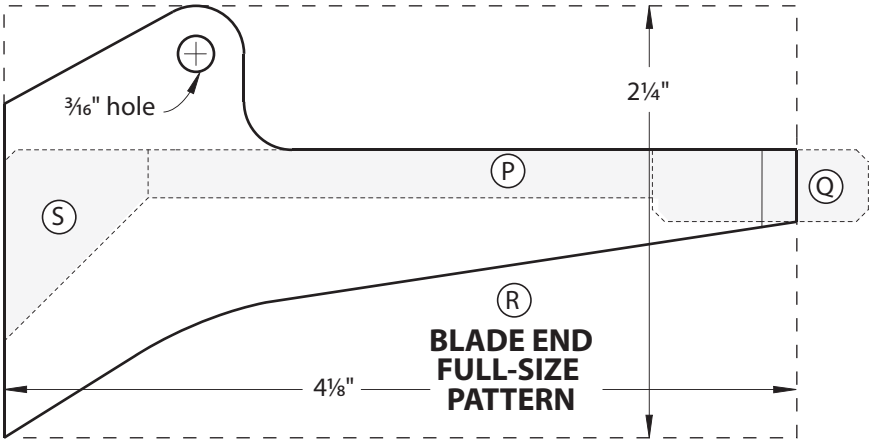

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SHOP TESTED

Drill Presses

We test 8 workhorse models and give you the lowdown on which to buy.

Like a great character actor, a drill press doesn't enjoy the glamour or glory of a tablesaw or router, but it often still plays a critical—and often underappreciated—role in building projects. That's especially true when it comes to drilling precisely angled holes or multiple holes to the same depth.

For most routine drilling duties, a benchtop model packs sufficient capacity and power. (See our review of these models in the November 2007 issue.) But for the most demanding tasks, such as boring deep mortises, plowing a 3" Forstner bit into hardwoods, or drilling into the end of a long workpiece (think: lamp), you'll want to step up to a floor-standing drill press. To help you get the most for your money, we shop-tested models in the 16–18" class. (That figure refers to "swing" capacity—the maximum width of workpiece into which you can drill to the center—measured by doubling the distance from the front of the support column to the center of the chuck.)

Five qualities that matter in a floor-model drill press

1 **AMPLE TORQUE.** A machine this size should handle the largest bits, holesaws, and adjustable circle cutters you have without bogging down. We tested torque on each drill press by boring holes into hard maple, starting with a 2" Forstner bit. We then increased bit sizes in ¼" increments while maintaining the same feed rate to test each machine's limits.

Seven of the eight presses matched each other bit for bit, with only slight bogging down when we got up to a 3" bit. But slowing our feed rate a little compensated for this so that each of the seven made the cut. By comparison, Craftsman's 22901 stalled frequently

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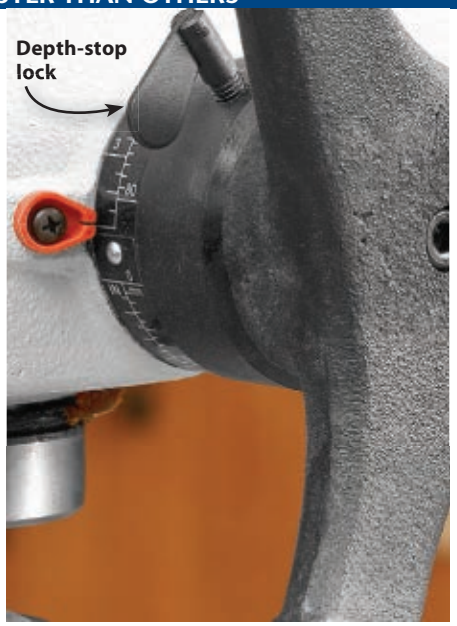
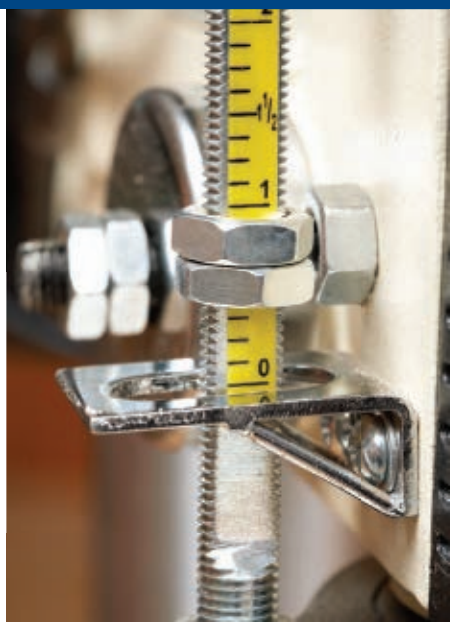
DEPTH STOPS: SOME YOU CAN SET FASTER THAN OTHERS

WAY FAST: To make coarse adjustments with Delta's single-nut stop, press the quick-release button to slide up and down. Then fine-tune by twisting it around the threads.



FAST: To set the dial depth stop on the Rikon, spin the gauge ring on the hub and align the desired depth marking with the indicator; then tighten the lock.



NOT SO FAST: With dual-nut depth stops (shown here on the Shop Fox) you set the bottom nut, then lock the top nut against it, either by hand or with wrenches.

until we slowed our feed rate considerably. Craftsman's George Gibson attributed this slippage to paint inside the spindle pulley's tapered bore, and said it would be corrected on future models. Once we removed that paint and eliminated that problem, the Craftsman then began to experience belt slippage with bits larger than 2½" in diameter.

2 DEPTH-STOP RELIABILITY. Tested presses have three types of depth-stop systems (*above*): a threaded rod with a single knurled, quick-adjust nut; a threaded rod with two locking nuts; and a dial stop on the quill-handle hub. To test them for ability to maintain a setting, we set their depth stops to ⅜" and then drilled 100 ½"-diameter holes in MDF with each model. All passed this test with flying colors.

3 EASY SPEED CHANGES. As a rule of thumb, the larger the bit diameter, the slower the speed, so you'll need to change spindle speeds frequently, perhaps as often as you change bits. The Powermatic PM2800 makes this a snap with its continuous variable-speed selector (a lever you simply slide backward or forward with the motor running), shown *below left*. Although it's noisier than the other machines, we like the convenience, smooth movement, solid lock, and digital speed readout on the front.

With the rest of the machines you lift the hood, loosen tension on the sliding motor mount, and reposition two belts on the three pulleys. None proved overly difficult, but short motor-mount handles on the Craftsman, Jet JDP-17DX (shown *below*), Rikon 30-230, and Shop Fox W1680 made it tougher to get the right amount of tension. And because the Grizzly G7947 stands nearly 6' tall, a person less than that height might need a step stool to reach the belts.

CHANGING SPINDLE SPEEDS: THE BEST ONES MAKE IT EASY

SUPER EASY: To change Powermatic's speed, twist the knob to unlock and, with the motor running, slide the lever forward or backward.

EASY: Although most hoods are hinged on one side, Delta's lifts up and back to give you access from either side for changing the belts.

NOT AS EASY: A short lever makes it tougher to get adequate belt tension, sometimes creating belt slippage during drilling.

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TABLE SETTING TAKES NO TOOLS

To tilt Delta's table sideways, pull out the quick-release lock and rotate the table. It also tilts forward.

SLIDE THE SIDES TO STRETCH SUPPORT

Powermatic's table extends to 26" for added workpiece support, and comes with a 3"-tall aluminum fence and dust housing with a 1½" port.

4 WOODWORKER-FRIENDLY TABLES. Most of the tested models have tables better suited for metalworking than woodworking, with support gussets crisscrossing the underneath side—limiting clamping space—and a perimeter trough to catch metal-cooling lubricants. Fortunately, four (Craftsman, Delta, Jet, and Powermatic) have tables friendly to woodworkers.

We like Delta's generous table best because its thin rim, twin T-slots, and four diagonal slots make it easy to mount or clamp down workpieces and jigs. A 3¾"-square MDF insert backs up drilled holes to eliminate surface tear-out. You can remove the insert to take advantage of the 3" center hole for use with sanding drums. This table, shown *above*, tilts 90° left and right for angled drilling, and it's the only one to also tilt forward, up to 45°. And it requires no tools for table adjustments.

Powermatic's table, shown *above right*, measures 16" wide, but increases to as much as 26" when you extend its two wings. It has a 3" center hole with a plastic insert that reduces to 1½", making it possible to get close support when using sanding drums. The PM2800 tilts 90° left and right; all the others stop at 45°.

5 LACK OF RUNOUT. You cannot do precise work if a bit wobbles due to runout—any variance from center while spinning—in the spindle or quill. Fortunately, none of the tested models showed any signs of runout.

Less-pressing concerns

■ **CHUCKS THAT GRIP.** All of the chucks kept tight bites on bits within their jaws, even under high-torque applications. Two drill presses, Craftsman and Powermatic, come with keyless chucks with ⅝" capacity. Although convenient because you don't have to reach for a chuck key, after high-torque boring tasks, we found it difficult to loosen those chucks by hand and had to use adjustable pliers.

■ **USER-FRIENDLY QUILL STROKE/LOCK/HANDLES.** Five units give you at least 4⅜" of stroke—the plunge capacity of the chuck—topped by the 4⅞" of the Craftsman and Delta. We like this extra capacity, especially for drilling mortises.

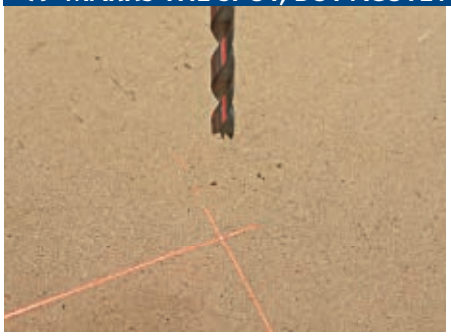
All but the General International and Grizzly have a quill lock to fix the chuck at a desired depth, as you'd do if using a sanding drum to lock it in place partially below the table surface. This also proves handy when installing a mortising attachment. (See sidebar, *next page*.)

Long quill handles provide leverage on tough jobs, such as boring with large bits or using a mortising attachment. But stubby handles on the Rikon come up short, forcing you to work harder.

■ **LASERS SHOULD AID PRECISION.** Five machines sport red cross-hair lasers to align your marked hole location with the bit's centerpoint. The lasers on the Jet, shown *below left*, and Powermatic proved best with thin, bright lines that intersect at about 90°. Lasers on the Craftsman and General International, shown *below right*, intersect at steeper angles, making alignment more difficult, and proving more susceptible to bumping out of alignment. Delta's lasers intersect at a good-enough 75°.

■ **FLEX-LIGHTS WORK BEST.** Delta's and Craftsman's flexible-neck incandescent task lights help you direct the light where you want it. Powermatic's LED lights mount above the chuck and in front of the quill, providing decent illumination. All the rest feature incandescent bulbs (not included) mounted in the head behind the quill. But the chuck and large bits block these lights, creating shadows on the target area.

"X" MARKS THE SPOT, BUT ACUTE ANGLES DIMINISH ACCURACY



Laser lines on the Jet intersect at a perpendicular angle, giving you a precise cross-hair to place on your mark.

General International's lasers overlap for more than ⅛", making it difficult to pinpoint an exact drilling location.

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An in-depth look at the presses

Craftsman 22901, $600

800-383-4814, craftsman.com

High Points:

- Test-best quill stroke of 4⅞".
- Mounted on the column is a tool tray with cutouts for 12 bits, and a chart inside the hood lists spindle speeds for a variety of bits and materials.

Low Points:

- Struggled more than the others to drill large holes—exhibiting belt slippage.
- Its single multiposition handle proved difficult to use, especially for bores that need a long stroke.
- The battery-powered cross-hair lasers easily bump out of alignment and intersect at a steep angle, making pinpoint accuracy difficult.

More Points:

- We found it convenient most times to change bits with the keyless chuck, but high-torque boring resulted in stuck bits, requiring adjustable pliers to loosen the chuck.
- Clamping workpieces to the table proved easy with its thin, flat rim. But to tilt the table you need an open-end wrench that's not provided.

Delta 17-959L, $580

800-223-7278, deltaportercable.com

High Points:

- Test-best quill stroke of 4⅞".
- Our favorite table: It tilts 90° left and right as well as 45° forward—the only one with this feature—and it's easy to clamp to the edges and in the convenient T-tracks.
- Accurate, easy-to-see, electrically powered cross-hair lasers make pinpoint bit placement easy.
- With the largest base, this machine proved the most stable in the test.
- A crank that's angled toward the back makes table-height adjustments easy and eliminates knuckle-banging.

Low Points:

- No chuck-key holder.

More Points:

- To change belts, you lift the hood up and back, providing access from either side.
- Works well with optional mortising attachment (#17-924, $90) and sanding drums.

General International 75-200RC M1, $480

888-949-1161, general.ca

High Points:

- A flip-down guard prevents accidents around the chuck—a good idea because the chuck key lacks a spring-loaded safety pin.
- Long quill handles deliver ample leverage.

Low Points:

- Requires two open-end wrenches to tilt the table, but neither are included.
- Without a quill lock, you can't secure the chuck in a lowered position.
- You must remove a screw with a screwdriver to open the hood for speed changes.
- The battery-powered cross-hair lasers easily bump out of alignment and intersect at a steep angle, making pinpoint accuracy difficult.
- The chuck key did not fit in the onboard chuck-key holder.

More Points:

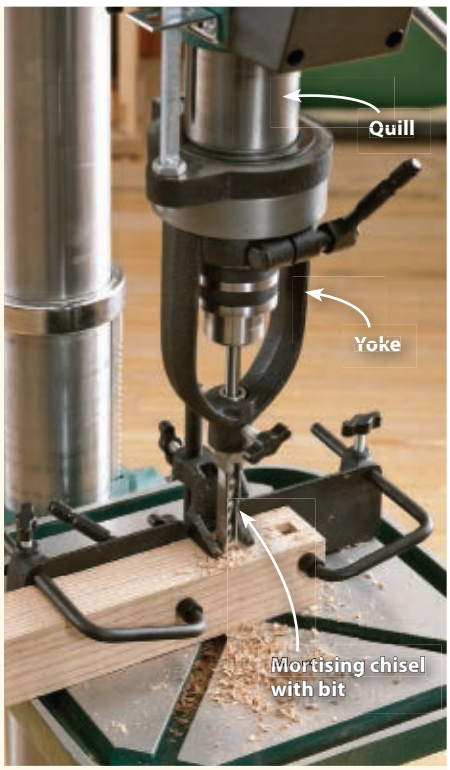
- Safety lock-out on the power switch engages with each shutdown and is difficult to open again.
- Mortising with the optional attachment (#70-905, $120) proves accurate, but setup proves more finicky than with other makes.

Make it a mortiser and bore square holes

For $64 to $130 you can purchase a mortising attachment for four of the tested drill presses (Delta, General International, Grizzly, and Rikon). Mounted to the quill, as shown at *right*, the bit-and-chisel combination helps you make mortises with square corners and flat walls, just as with a dedicated mortising machine.

After you've done it a few times, installing a mortising attachment takes about 15 to 20 minutes. But once you've installed it, you cannot use your drill press for any other operation, because the yoke blocks the chuck. To make mortises with one of these units, expect to exert more arm strength than you would if using the long handle of a dedicated mortising machine.

If you plan to make mortises only occasionally, then one of these kits should prove adequate while saving you money. But if you regularly build projects with mortise-and-tenon joints, then you'll appreciate the convenience and quicker setup of a benchtop mortiser. They sell for about $225 to $500.



When making mortises with one of these attachments, cut the ends first and then chisel out the middle in overlapping cuts.

Grizzly G7947, $525

800-523-4777, grizzly.com

High Points:

- Its large base adds stability to a top-heavy machine.
- Greatest drilling capacity from base to chuck.

Low Points:

- Without a quill lock, you can't secure the chuck in a lowered position.
- No chuck-key holder.

More Points:

- Users under 6' tall will likely need a step stool to change belts on this unit, tallest in the test.
- Includes wrenches for tilting the table, but the table is better suited for metalworking.
- Works well with optional mortising attachment (#H7789, $64).

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Floor-Standing Drill Presses: Power, capacity, and

MANUFACTURER	MODEL	DIMENSIONS, INCHES		SWITCH STYLE (2)	DRIVE SYSTEM		CHUCK, SPINDLE, AND QUILL						TABLE			
		SWING (1)	OVERALL, H×W×D		NUMBER OF SPINDLE SPEEDS (3)	SPINDLE SPEED RANGE, RPM	CHUCK CAPACITY, INCHES	CHUCK TYPE (4)	MAX. HEIGHT, CHUCK TO TABLE, INCHES	MAX. HEIGHT, CHUCK TO BASE, INCHES	MAX. QUILL STROKE, INCHES	TYPE OF DEPTH STOP (5)	QUILL LOCK? (YES, NO)	SIZE (W×D), INCHES (6)	CENTER HOLE DIAMETER, INCHES (7)	MAX. TILT ANGLE, LEFT AND RIGHT, DEGREES	MAX. TILT ANGLE, FORWARD, DEGREES
CRAFTSMAN	22901	17	68½×12¾×28½	PB	16	215–2,720	⅝	L	23½	43½	4⅞	A	Y	14×14	1	45	0
DELTA	17-959L	17	70×18×28	PB	16	215–2,750	⅝	K	24½	44½	4⅞	A	Y	18×14	3*	90	45
GENERAL INTERNATIONAL	75-200RC M1	17	64½×14×26½	PB	12	340–2,800	⅝	K*	27⅞	48	3¼	N	N	12×12	1	45	0
GRIZZLY	G7947	17	71×21×30	T	12	210–3,300	⅝	K	29	50¼	4¾	N	N	13⅝×13⅝	1	45	0
JET	JDP-17DX	16½	65×13×23½	PB	16	230–3,630	⅝	K	29⅛	49	4⅜	N	Y	18½×14½	2 11/16#	45	0
POWERMATIC	PM2800	18	68½×20×31½	PO	VS	400–3,000	⅝	L	26½	47	4⅜	N	Y	16×14/26×14*	3†	90	0
RIKON	30-230	17	64⅜×13¾×28¾	T	16	220–3,630	⅝	K	25½	45¼	3⅛	D	Y	14×14	1¼	45	0
SHOP FOX	W1680	17	65¼×15×29	T	12	150–3,050	⅝	K	31½	49	3¼	N	Y	14 (diameter)	1	45	0

1. Largest workpiece (in width or diameter) into which you can drill to the center
2. (PB) Push-button; (PO) Pull-button; (T) Toggle
3. (VS) Variable speed
4. (K) Keyed; (L) Keyless; (*) Keyless chuck optional at same price
5. (A) Threaded rod with adjustable nut; (D) Dial depth stop; (N) Threaded rod with locking nuts
6. (*) With wings extended fully
7. (*) Hole is inside a 3¾" rabbeted square; (#) Hole is a 2 11/16" rabbeted square; (†) Plastic insert reduces opening to 1½"
8. (NA) Chuck is keyless
9. (I) Incandescent bulb mounted under head; (L) Light-emitting diode; (X) Incandescent bulb mounted on flexible arm

Jet JDP-17DX, $500

800-274-6848, jettools.com

High Points:

- A crank that's angled toward the back makes table-height adjustments easy, with more clearance for your hand.
- Accurate, easy-to-see, electrically powered cross-hair lasers make pinpoint bit placement easy.

Low Points:

- A short lever makes it difficult to set belt tension.

More Points:

- Woodworking-friendly table allows for easy clamping of workpieces and has a wooden center insert, but to tilt the table you need two wrenches that are not provided.

Powermatic PM2800, $900

800-274-6848, powermatic.com

High Points:

- Spindle-speed changes were easiest thanks to its variable-speed function and digital rpm readout.
- Accurate, easy-to-see, electrically powered cross-hair lasers make pinpoint bit placement easy.
- With extensions that reach a test-best 26" wide and a fence with a 1¾" dust port, this was our second-favorite table.

Low Points:

- Its slowest speed is 400 rpm, nearly twice that of all but one machine in the test.

More Points:

- We found it convenient most times to change bits with the keyless chuck, but high-torque boring resulted in stuck bits.

Rikon 30-230, $380

877-884-5167, rikontools.com

High Points:

- With a slowest speed of 220 rpm and a top of 3,630, this unit has the greatest range in the test.
- A chart inside the hood shows recommended spindle speeds.

Low Points:

- Short quill handles make it difficult to get leverage when using large bits or the optional mortising attachment (#29-201, $80).
- Requires two wrenches to tilt the table; only one is included.
- A short lever makes setting the correct belt tension difficult.

More Points:

- The only tested model with a dial-type depth stop on the quill handle, which proved accurate but not as intuitive as the rod-and-nut types.

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accuracy for all your drilling needs

FEATURES			PERFORMANCE GRADES (11)												ACCESSORIES (12)						
			PRIMARY				SECONDARY														
CHUCK-KEY HOLDER? (YES, NO) (8)	TASK LIGHT (9)	LASER POWER SOURCE (10)	POWER/TORQUE	DEPTH STOP DEPENDABILITY	EASE OF CHANGING SPEEDS	EASE OF USING CHUCK	HANDLE LEVERAGE	EASE OF MAKING TABLE ADJUSTMENTS	EASE OF CLAMPING TO TABLE	EASE OF DRILLING ANGLED HOLES	EASE OF USING SANDING DRUM	EASE OF USING MORTISING ATTACHMENT	OVERALL STABILITY	CLARITY OF OWNER'S MANUAL	STANDARD	OPTIONAL	WEIGHT, LBS	CORD LENGTH, FEET	WARRANTY, YEARS	COUNTRY OF ASSEMBLY (13)	SELLING PRICE (14)
NA	X	B	C	A	B-	B+	c	c+	a-	b	b	na	c	a	E,K,T	V	198	7	1	C	$600
N	X	A	A-	A	B+	A	a	a	a	a	a	b	b	a	K	M,V	268	6½	5	C	$580
Y	I	B	B+	A	B	A	a	c	c	b	c	c-	b	c+	G,K	M,T,V	200	5	2	T	$480
N	I	N	A-	A	B	A	a	b	c	b	c	b	b-	a	K,W	M,V	270	8½	1	C	$525
Y	I	A	B+	A	B-	A	a	c+	a	b	a	na	b	a	K	V	209	6	5	C	$500
NA	L	A	A	A	A	A-	a	c	a	b+	a	na	b	a	F,K		209	7½	5	C	$900
Y	I	N	B+	A	B-	A	c-	c	c	b	b	c	b	c-	K	M,V	188	7	2	C	$380
N	I	N	B+	A	B-	A	a	c-	c	b	b	na	b	a	K,W	V	175	9	2	C	$420

10. (A) AC current
(B) Battery
(N) No laser

11. A Excellent
B Good
C Fair

12. (E) Table extension
(F) Table fence
(G) Chuck guard
(K) Chuck knockout tool
(M) Mortising attachment
(T) Tool tray
(V) Work-holding vise
(W) Table-tilt adjustment wrench

13. (C) China
(T) Taiwan

14. Prices current at time of article production and do not include shipping, where applicable.

You can't go wrong with either of these machines

Two drill presses jumped to the head of the class to share Top Tool honors: the Delta 17-959L and the Powermatic PM2800. Both performed exceptionally with plenty of power and no significant flaws—the choice between the two comes down to what's more important to you: a superb table (Delta) or easy speed changes (Powermatic). The Delta table proved easy to clamp to, tilts 90° side-to-side and 45° forward without tools, and has a replaceable center insert. In addition, the $580 17-959L has an easy-to-adjust and reliable single-nut depth stop, as well as accurate lasers.

With the Powermatic you can change speeds on the fly without getting your hands dirty. It, too, has a dependable depth stop and accurate lasers, but sells for $320 more.

Should both of these fall out of your price range, consider the Shop Fox W1680, our Top Value, for $420. It lacks frills, but proved accurate with ample power. The round table's not one of our favorites, but it works acceptably for most applications.

Written by **Bob Hunter** with **Bill Link**

Shop Fox W1680, $420

800-840-8420, shopfox.biz

High Points:

- Its 150 rpm is the slowest in the test, a plus for working with very large bits or wide circle cutters.
- At 31½", it has the greatest drilling depth from chuck to table.

Low Points:

- No chuck-key holder.
- A short motor-mount lever makes it difficult to set the correct belt tension.
- Requires two wrenches to tilt the round table; only one is included.

New Delta drill press on the horizon

Although the Delta 17-959L earned a share of Top Tool honors in this review, Delta plans to replace this model in early 2011 with an 18" version. Delta's Bill Harman says the 18-900C (shown here) will sell for about $830 and be similar to the existing unit, but with enhanced features for greater torque, table movement, stability, and bit visibility. Harman said Delta will also launch a variable-speed version at a later date. Watch for test results in an upcoming issue of *WOOD*® magazine.

More Resources

FREE DOWNLOAD

- Drill Press Speed Chart provides recommended speeds for various bits in a range of diameters at woodmagazine.com/drillpresschart.

FREE VIDEOS

- "Drill Press Tips and Techniques" and "Trick Out Your Drill Press" at woodmagazine.com/dpvideos.

RELATED ARTICLE

- "Benchtop Drill Presses" tool review in issue 180 (November 2007) or download it online at woodmagazine.com/benchtopdp. $

($=Download this article for a small fee.)

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PROJECT HIGHLIGHTS

- Overall dimensions: 8⅜" wide × 13¼" long × 7 1/16" high
- Blade width: 7¾"
- Ground clearance: ¼"
- Track gauge: 4½"
- Power transmission: Manual
- Fueled by imagination

Construction-Grade Bulldozer

Clear the way to every kid's dream of operating heavy machinery.

For simply pushing blocks around a playroom, or gathering compliments about your woodworking, this 'dozer gets the job done. As it lumbers across the "job site," its operator can lift and lower the blade just like on the real thing. This third project in our "Construction-Grade" series works right alongside the excavator (issue 194, November 2009) and the crane (issue 185, September 2008) [**photo**, *page 61*].

Build the undercarriage

1 From 1½"-thick walnut (or laminated ¾" walnut), cut a 3×17" blank. From this blank, cut the chassis (A) to size [**Materials List**], and set the rest aside. On the chassis, lay out the 11/32" holes and the chamfers [**Drawing 1a**]. Drill the holes at the drill press. Bandsaw just outside the chamfer lines, then sand to the lines.

2 Make a copy of the **Radiator Pattern** from the *WOOD Patterns*® insert.

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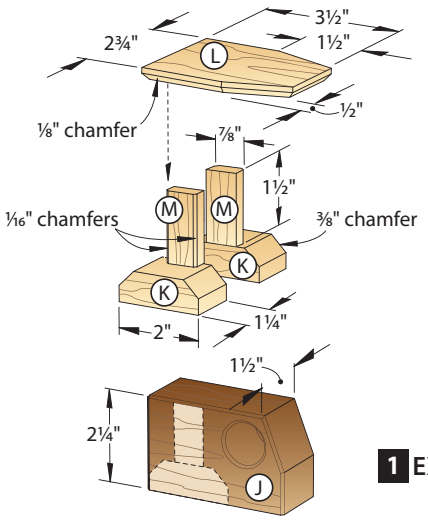
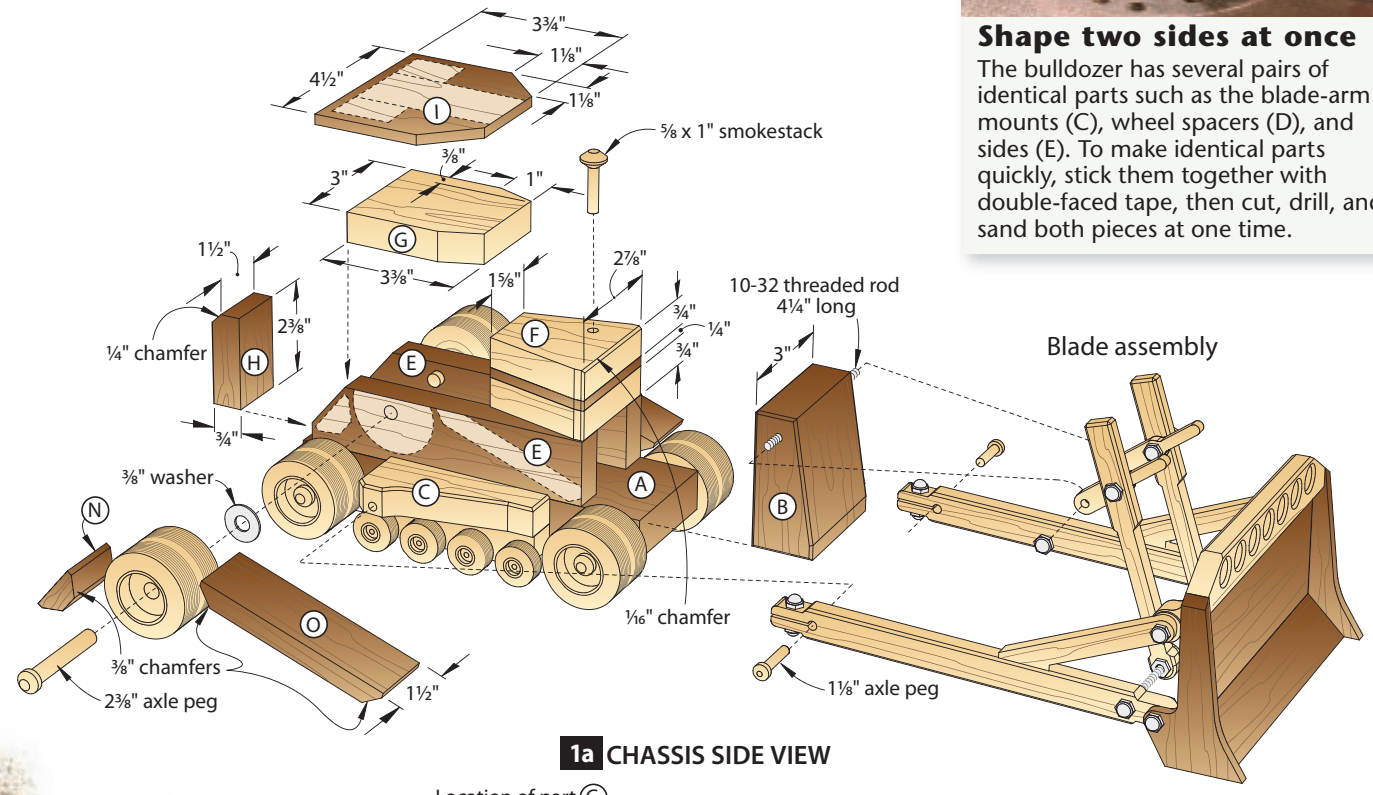
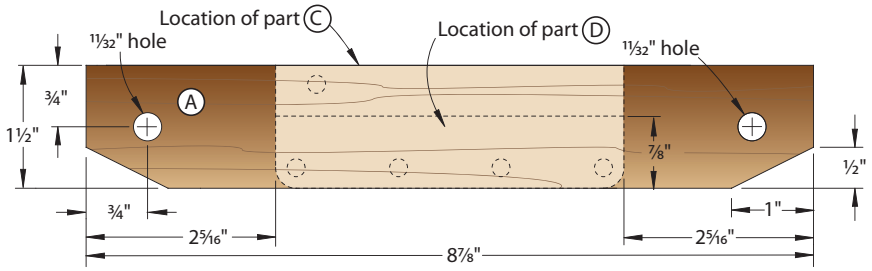


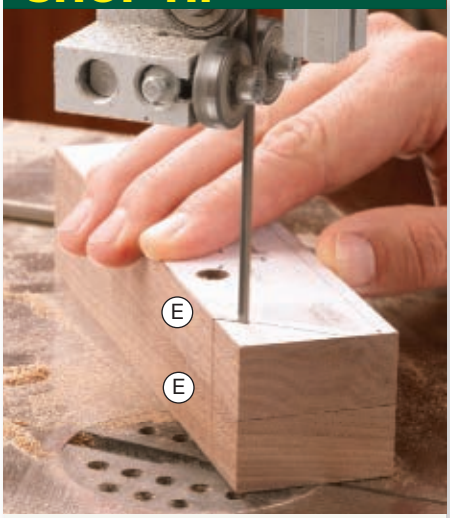
1 EXPLODED VIEW



1a CHASSIS SIDE VIEW



SHOP TIP



Shape two sides at once

The bulldozer has several pairs of identical parts such as the blade-arm mounts (C), wheel spacers (D), and sides (E). To make identical parts quickly, stick them together with double-faced tape, then cut, drill, and sand both pieces at one time.

Retrieve the walnut blank, spray-adhere the pattern to the edge of the blank flush with one end, and bandsaw and sand the radiator (B) to shape. Save the cutoff for the cab (J). Drill the 3⁄16" hole at the drill press. Use mineral spirits to remove the pattern, then rout the chamfers around the edges. Sand the chassis (A) and radiator to 220 grit. Glue the radiator to the chassis with their front edges flush [**Photo A**].

3 Cut two blanks for the blade-arm mounts (C) [**Drawing 2**]. Make a copy of the **Blade-Arm Mount Pattern**, spray-adhere it to a blank, and bandsaw and sand both mounts to shape [**Shop Tip**, *above*]. Drill the holes where shown. Separate the blade-arm mounts, sand them through 220 grit, then rout the chamfers along the top outside edges.

4 Cut two wheel spacers (D) to size [**Drawing 2a**]. Lay out and drill the holes where shown, then sand the ⅜" radius at each end. Sand the spacers to

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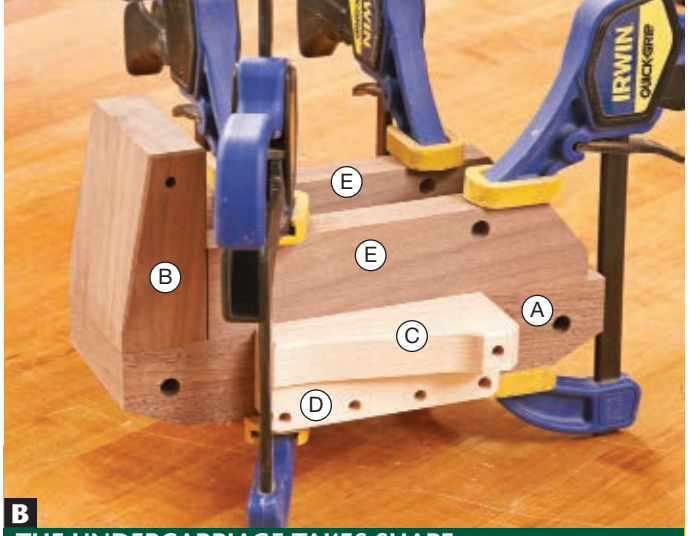
A CLAMPING TO A CHAMFERED END

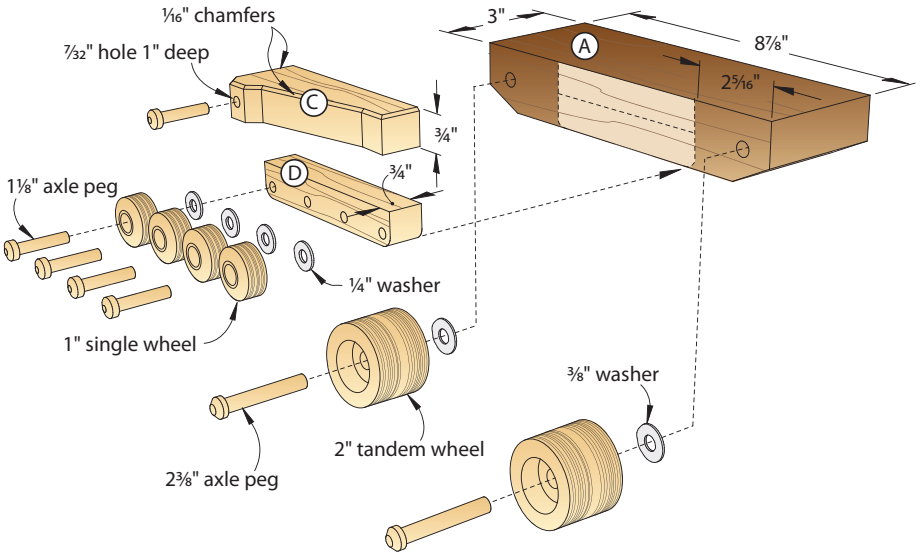
Clamp the chassis (A) to your bench to prevent it from tipping. Clamp the radiator (B) to the chassis.



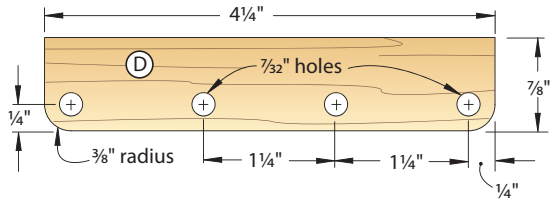
B THE UNDERCARRIAGE TAKES SHAPE

Glue the sides (E) against the back face of the radiator (B) and flush to the outside edges of the chassis (A).

2 CHASSIS ASSEMBLY



2a WHEEL SPACER SIDE VIEW



220 grit, then glue a blade-arm mount (C) to each wheel spacer with their ends and back faces flush [**Drawing 2**]. After the glue dries, glue these assemblies (C/D) to the chassis (A) centered on its length [**Drawing 1a**].

5 From ¾" walnut, cut two sides (E). Make a copy of the **Side Pattern,** spray-adhere it to a blank, then drill the hole and bandsaw and sand the sides to shape. Separate the sides, sand them to 220 grit, then glue and clamp the sides to the chassis assembly (A–D) [**Photo B**].

Add the body

1 Cut two ¾×3×3" maple blanks and a ¼×3×3" walnut blank. Laminate the walnut between the maple pieces with the edges flush. After the glue dries, make a copy of the **Hood Pattern**, and spray-adhere it to the blank. Bandsaw and sand the hood to shape, and drill the hole for the smokestack [**Drawing 1**]. Sand the hood to 220 grit, then rout a 1/16" chamfer on the top front and two vertical edges. Glue the hood to the top of the sides (E) tight to the radiator (B).

2 Bandsaw and sand the cab riser (G), back (H), and cab platform (I) to shape [**Drawing 1**]. The back should fit snugly between the sides (E). For the cab (J), retrieve the cutoff blank from earlier and spray-adhere a copy of the **Cab Pattern** to it. Bandsaw and sand the cab to shape. Then drill the hole where shown and chamfer both faces.

3 Cut a ¾×5½×2" blank for the cab sides (K). Rout a ⅜" chamfer on each end, then crosscut the cab sides to width. Bandsaw and sand the roof (L) to shape, and chamfer its bottom edges [**Drawing 1**]. Cut a ⅜×⅞×4" blank for the roll bars (M) and rout 1/16" chamfers along both edges of one face. From this blank, cut the roll bars to fit between the cab sides and the top of the cab. Sand the cab sides, roof, and roll bars to 220 grit.

4 ***Quick Tip! Five-minute clamp time.*** As you glue parts G through M in place, clamp parts for just five minutes. The glue develops enough "grab" that the part won't move as you work on the next piece. Glue and clamp the cab riser (G) to the sides (E), tight to the rear of the hood (F) [**Drawing 1**]. Next, glue the back (H) between the sides and against the cab riser. Glue and clamp the cab platform (I) to the riser, centered on its width and snug against the hood. Glue the cab (J) to the platform, centered on its width and against the hood. Then

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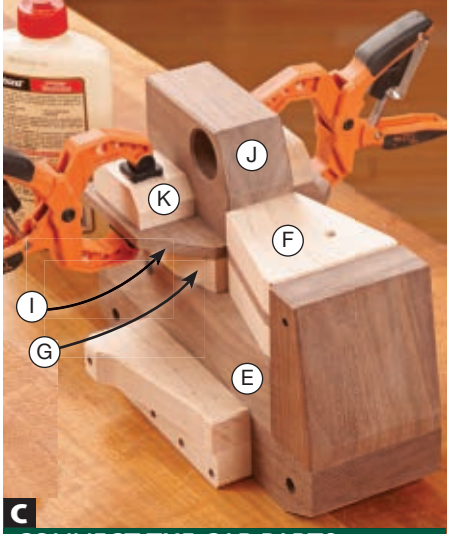
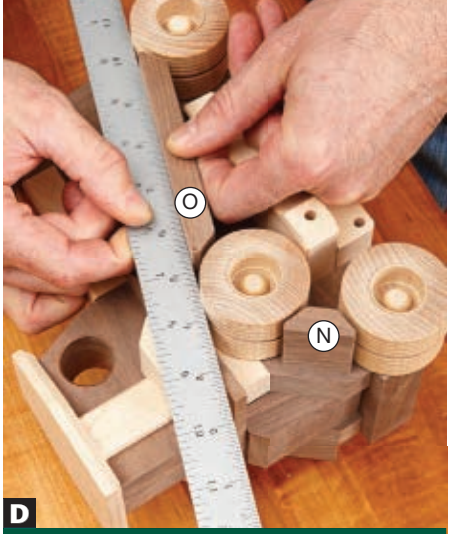


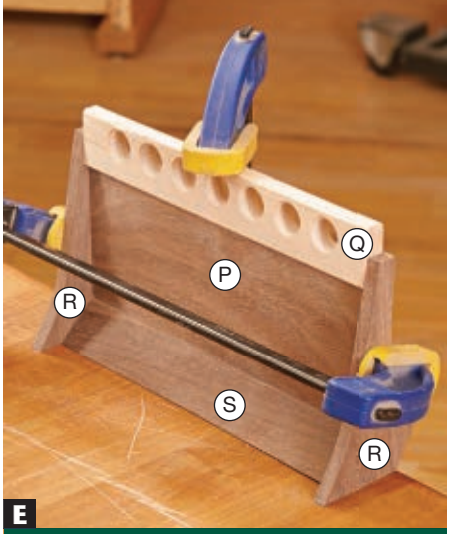
C CONNECT THE CAB PARTS

Glue the cab sides (K) to the cab platform (I) only, not to the cab (J). Spring clamps fit the tight space.



D TRACKING TRUE

Bridge two wheels with a straightedge to position the upper face of the tracks (N, O). Hold them in place for a couple of minutes.



E GLUE ON THE SIDES

Clamp the blade assembly (P/Q/S) to your bench, then glue and clamp the blade ends (R) to it, flush at the back.

glue and clamp the cab sides (K) to the cab platform [**Photo C**]. Align their ends with the chamfers on the cab [**Drawing 4**]. Glue the roll bars (M) to the cab, centered on the cab sides' length, then add the roof (L) centered on the cab's top.

Get on track

1 Cut a ½×1½×13" walnut blank. Make two copies of the **Top Track Pattern** and **Back Track Pattern** and spray-adhere them along one edge of the blank. Bandsaw and sand the tracks (N, O) to shape and sand them to 220 grit.

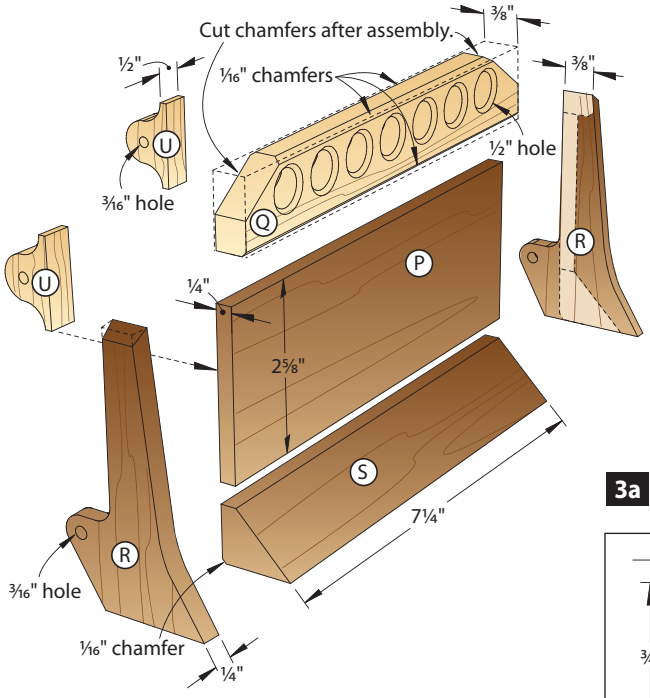
2 Temporarily install the dual wheels and axle pegs [**Source**] on one side of the undercarriage/body (A–M). Use the wheels as reference points to position and glue the tracks in place [**Photo D**]. Let the glue dry for 30 minutes, then repeat the process for the opposite side.

Switch to the blade

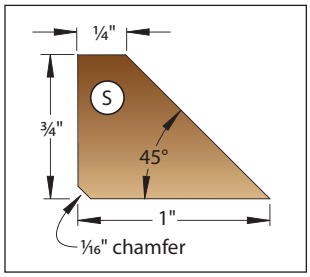
1 Cut the blade back (P) to size and set it aside. Cut blanks for the blade top (Q) and blade ends (R) [**Drawing 3**]. Spray-adhere the patterns to the blade ends and blade top, then stack-cut and sand the blade ends to shape. ***Note:*** *Do not cut the chamfers on the ends of the blade top yet.* Drill the holes in the blade top and blade ends where indicated. On the blade top, rout 1/16" chamfers on both top edges, the bottom front edge, and around the holes. Remove the patterns from the pieces and sand them to 220 grit.

2 Bevel-rip the edge of a ¾"-thick blank for the blade bottom (S), then rip the piece to finished width [**Drawing 3a**]. Rout a 1/16" chamfer on the rear edge and sand the blade bottom to 220 grit.

3 BLADE



3a BLADE BOTTOM END VIEW



3 Apply glue to the top and bottom edges of the blade back (P) and clamp the top (Q) and bottom (S) to it with their rear faces flush. After the glue dries, glue the blade ends (R) to this assembly [**Photo E**]. Let the glue dry, then bandsaw the ends of the assembly [**Photo F**].

4 Plane a 4×13" maple blank to ½" thick. Rip two ⅞"-wide strips from it for the blade arms (T) and brackets (U). Crosscut a bracket from each strip, then rip the remaining strips to ¾" wide for the arms. Plane the original blank to ⅜" and rip two ⅝"-wide blanks for the lifts (V) and braces (W). Plane the blank to ¼" and cut blanks from it for the blade pivots (X). Make a copy of the patterns for parts T–X and spray-adhere them to the appropriate blanks. Cut and sand the parts to shape, drill holes where

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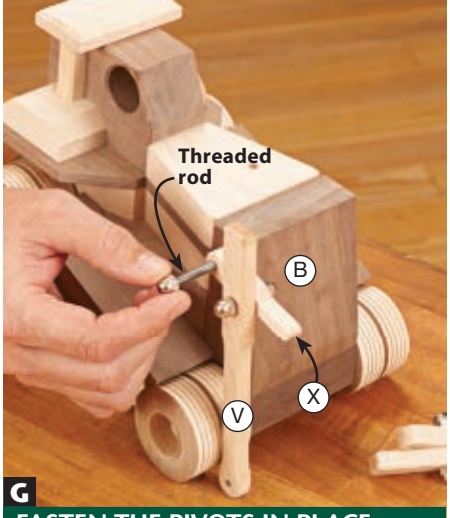
F **A SPACER LEVELS THE BLADE**

Level the blade assembly (P–S) with a scrap spacer before bandsawing the chamfer on each end. Sand the chamfers smooth.



G **FASTEN THE PIVOTS IN PLACE**

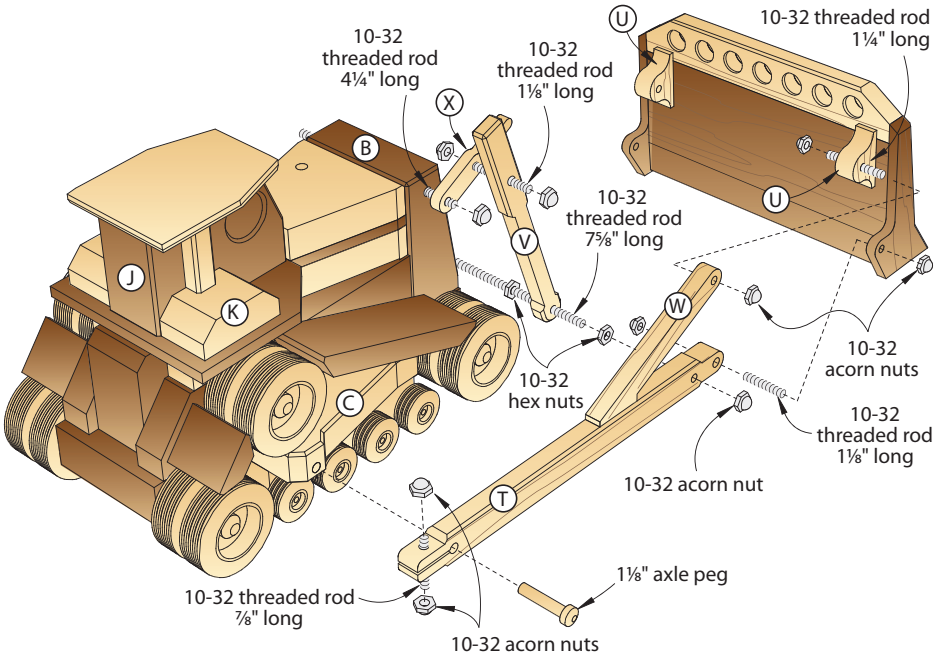
Feed a 4¼"-long threaded rod through a blade pivot (X), then through the radiator (B). Then place the opposite pivot on the rod.

SHOP TIP

Go nuts for clean threads

Cutting threaded rod with a hacksaw leaves burrs that prevent nuts from threading on. To restore damaged threads, position a nut on each side of the blade before making the cut. Removing the nuts cleans up the burrs.

4 **BLADE ASSEMBLY**
(Left arm assembly not shown for clarity)



indicated, then sand the parts to 220 grit. Rout 1/16" chamfers on the arm and lift where indicated on the patterns.

5 Hacksaw lengths of threaded rod for the blade assembly [**Drawing 4**; **Shop Tip**, *above right*]. Join each blade pivot (X) to a lift (V) with a 1⅛"-long section of threaded rod and two acorn nuts, making a mirrored pair of assemblies. Fasten these assemblies to the radiator (B) [**Photo G**].

6 Join each blade brace (W) to a bracket (U) with a 1¼" length of threaded rod and acorn nuts, again making mirrored assemblies. Use 1⅛" axle pegs to temporarily fasten the arms (T) to the blade-arm mounts (C) [**Drawing 4**]. Slide a rubber band up each arm [**Photo H**] before fastening the blade (P–S) to the arm with a threaded rod and acorn nuts. Put a dab of glue on each brace and bracket and glue them in place with the bracket just below the hole in the blade top (Q) [**Photo H**]. Allow the glue to dry.

7 Remove the blade parts (P–X) from the body (A–O) and discard the rubber bands. Attach the pivot and lift assembly (X/V) to the blade assembly using a 7⅝" length of threaded rod, four nuts [**Photo I**], and two acorn nuts. Reattach the arms (T) to the blade-arm mounts (C) and test the fit and operation of the blade.

Finish it up

1 Remove the blade assembly (P–X) and disassemble the parts joined with threaded rod. Remove the dual wheels. Tape off the stems of the axle pegs and the bottom 5/16" of the smokestack, then apply a finish to all pieces. (We sprayed on three coats of polyurethane, sanding lightly between coats with 320-grit sandpaper.)

2 After the finish dries, remove the tape from the smokestack and axle pegs and glue the smokestack into the hood (F). Place an axle peg through each wheel and a washer [**Drawings 1, 2**]. Glue the pegs to the wheel spacers (D), chassis (A), and sides (E).

3 Reassemble the blade assembly using blue thread lock on the acorn nuts. Insert axle pegs through the arms (T)

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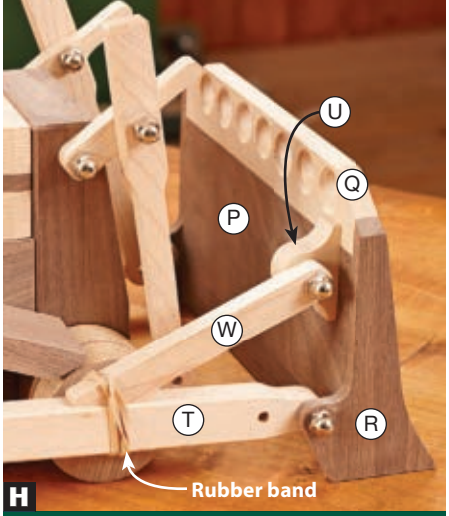
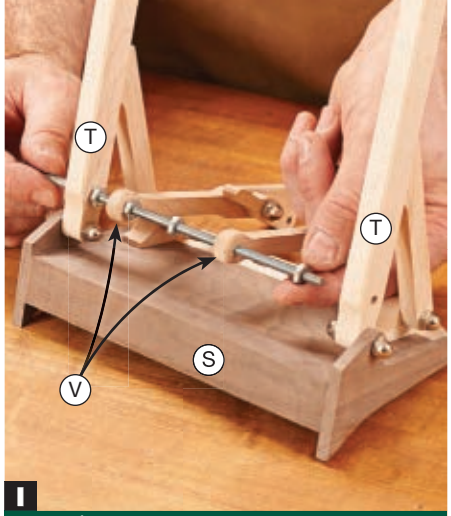


H

GLUE THE BRACE AND BRACKET

With the blade (P–S) flat on the bench and secured to the arm (T), glue the brace (W) and bracket (U). Clamp with a rubber band.



I

DON'T FORGET THE NUTS

Thread on a nut as the rod passes through the arm (T). Thread two more after the first lift (V) and the fourth after the second lift.

and insert the pegs into the blade-arm mounts (C) (don't use glue). Insert ⅞" lengths of threaded rod through the back of the arms, apply thread lock, and tighten the acorn nuts just enough that the blade lifts and lowers, but stays at a set position. Now find a driver willing to see if you've "made the grade."

All three pieces in our "Construction-Grade" series work hard. The crane, *left* (issue 185, September 2008), lifts and lowers its bucket and spins, and the excavator, *below* (issue 194, November 2009), has an articulated boom for reaching and scooping. Download the plans for a small fee at woodmagazine.com/plans. Type "crane" in the search box to find both plans.

Materials List

Part		FINISHED SIZE T	W	L	Matl.	Qty.
Undercarriage						
A*	chassis	1½"	3"	8⅞"	W	1
B*	radiator	1½"	3"	3⅜"	W	1
C*	blade-arm mounts	¾"	1⅝"	4¼"	M	2
D	wheel spacers	¾"	⅞"	4¼"	M	2
E	sides	¾"	1⅝"	7⅛"	W	2
Body						
F*	hood	1¾"	2⅞"	2¾"	W/M	1
G	cab riser	¾"	3"	3⅜"	M	1
H	back	¾"	1½"	2⅜"	W	1
I	cab platform	¼"	4½"	3¾"	W	1
J*	cab	1½"	2¼"	3½"	W	1
K*	cab sides	¾"	1¼"	2"	M	2
L	cab roof	⅜"	2¾"	3½"	M	1
M*	roll bars	⅜"	⅞"	1½"	M	2
Tracks						
N*	back tracks	½"	1½"	1¼"	W	2
O*	top tracks	½"	1½"	4⅝"	W	2
Blade						
P	blade back	¼"	2⅝"	7¼"	W	1
Q	blade top	⅜"	1⅛"	7¼"	M	1
R	blade ends	¼"	2¼"	4⅛"	W	2
S*	blade bottom	¾"	1"	7¼"	W	1
T*	arms	½"	¾"	9⅜"	M	2
U*	brackets	½"	⅞"	1½"	M	2
V*	lifts	⅜"	⅝"	6"	M	2
W*	braces	⅜"	⅝"	4¼"	M	2
X*	blade pivots	¼"	½"	2½"	M	2

*Parts initially cut oversize. See the instructions.

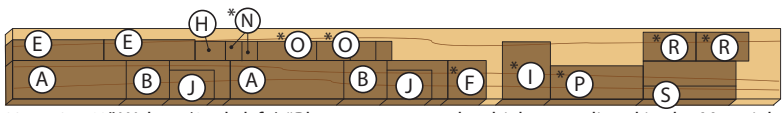
Materials key: W–walnut, M–maple.
Supplies: Double-faced tape, spray adhesive, blue thread lock.
Bits: 45° chamfer bit; 3⁄16", 7⁄32", ¼", 11⁄32", ½", 1" drill bits.

Source

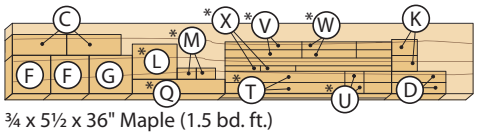
Wood/hardware kit: Contains the following wood parts and hardware: 2" tandem wheels (6), 2⅜" axle pegs (6), 1" single wheels (8), 1⅛" axle pegs (10), ⅝×1½" smokestack (1), 10-32×12" threaded rod (2), 10-32 acorn nuts (20), 10-32 hex nuts (4), ¼" washers (8), ⅜" washers (6). Kit no. 4043, $19.95 plus shipping, Meisel Hardware Specialties, 800-441-9870, meiselwoodhobby.com.

Produced by **Craig Ruegsegger** with **Jeff Mertz**
Project design: **Jeff Mertz**
Illustrations: **Roxanne LeMoine**; **Lorna Johnson**

Cutting Diagram



¾ x 5½ x 60" Walnut (2.5 bd. ft.) *Plane or resaw to the thicknesses listed in the Materials List.



¾ x 5½ x 36" Maple (1.5 bd. ft.)

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Dust-Catching Sanding Center

Overall dimensions:
36" wide × 24" deep × 33⅛" high (72½" with the arm)

You'll sand your projects fast and effectively with this easy-to-build, stow-out-of-the-way cart. It features a PVC arm that keeps the sander's power cord and vac hose out of your way. A tool-triggered switch powers on and off a low-dough vac stored on board. To make the project as easy to build as it is to use, build the no-nonsense drawers using metal sides with built-in slides. (See **Sources** on *page 66*.)

Put the cart before the hose

1 Cut the sides (A), bottom (B), top cleats (C), divider (D), and shelf (E) to size [**Materials List**, *page 66*]. Cut the bottom rail (F) and caster blocks (G) about 1" longer than shown. Then rabbet the inside back edges of the sides (A) [**Drawing 1**].

2 Clamp the top cleats (C) and bottom (B) between the sides (A) [**Photo A**] with the cleats flush with the sides at the top, front edge, and back-edge rabbet. Drill and screw the cleats, but not the bottom, to the sides.

3 Clamp the divider (D) to a side (A) with the front edges flush tight under the top cleats (C). Move and reclamp the bottom (B) against the divider and screw the bottom to the side [**Photo B**]. Now clamp the divider to the opposite side and repeat.

4 Clamp the shelf (E) to the top cleats (C) [**Photo C**] to use as a temporary spacer. Butt one face of the divider (D) against the edge of the shelf. Drill and screw the divider to the top cleats. Now clamp the shelf to the bottom (B) and repeat to drill and screw the divider to the bottom.

5 Drill a 2"-diameter hole in the shelf (E) where shown [**Drawing 1**]. Clamp the shelf between the side (A), 4½" from the upper end, and the divider (D). Then drill and screw the shelf in place.

6 Measure the bottom (B) between the sides (A). Cut the bottom rail (F) and caster blocks (G) to that length. Glue and screw the bottom rail set back ¼" and caster blocks where shown on the bottom. Then drill and screw the casters to the caster blocks.

7 Cut the back (H) to fit between the rabbets in the sides (A). Drill a 1½" hole where shown to accept cords coming from the tool-triggered switch, and set the back aside.

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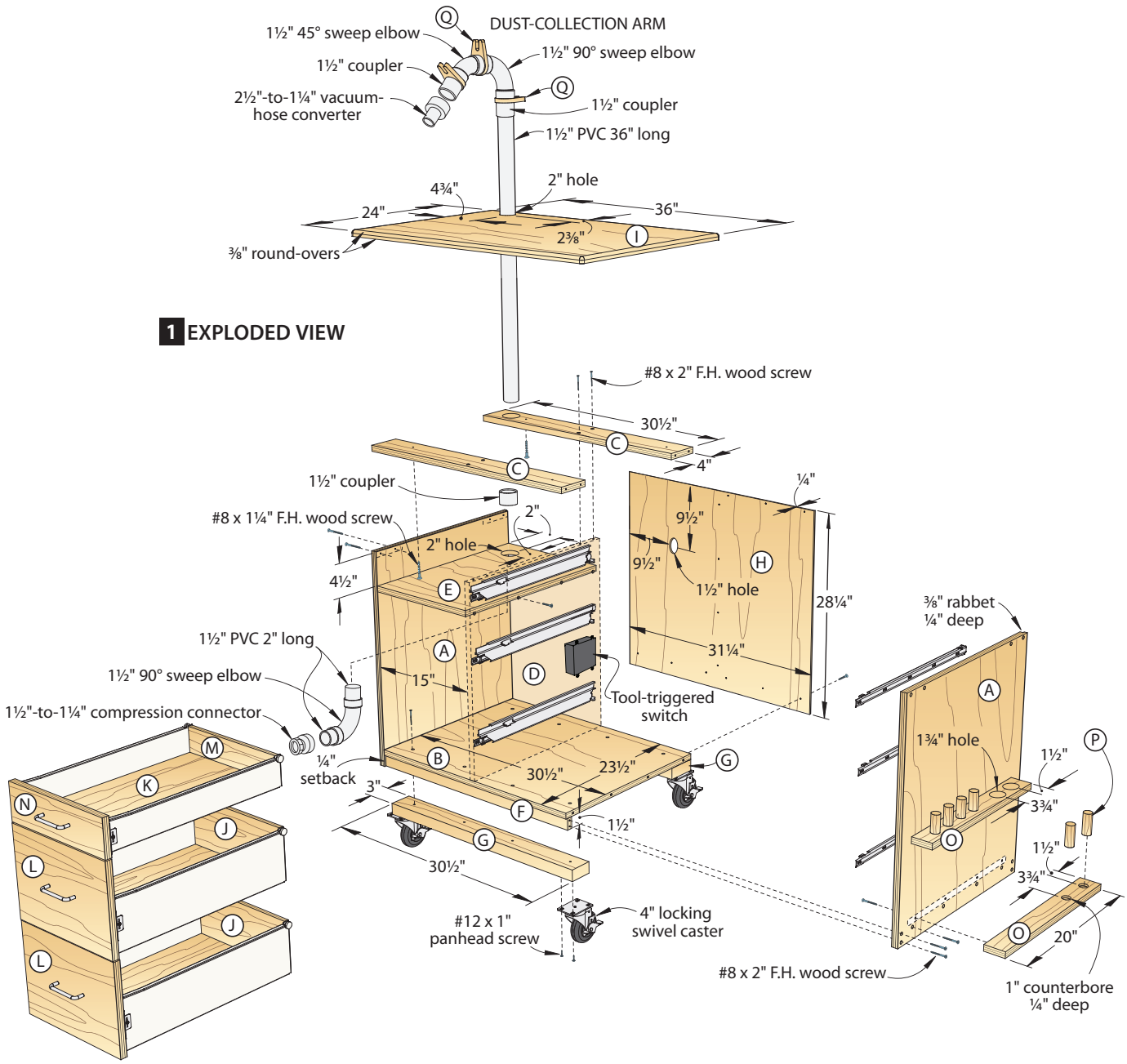
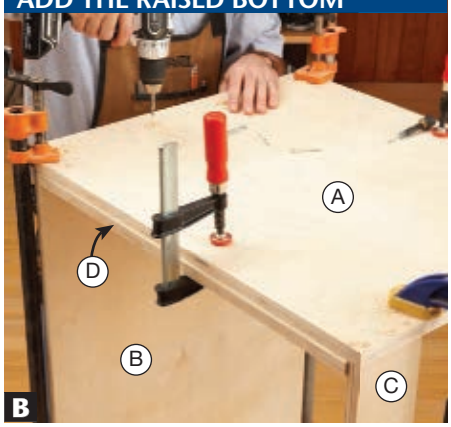


ATTACH THE TOP CLEATS

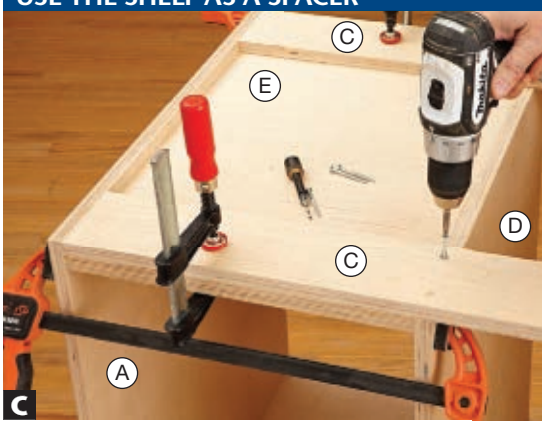
Add a right-angle clamping jig to the side (A); then the attach the top cleat (C). The bottom (B) supports the other end of the side.

ADD THE RAISED BOTTOM



Use the divider (D) as a gauge to position the bottom (B). Mark the side (A) to drill and drive screws centered in the ends of the bottom.

USE THE SHELF AS A SPACER



Clamp the shelf (E) to the top cleats (C) and butted against a side (A) to hold the divider (D) steady while you screw it to the cleats.

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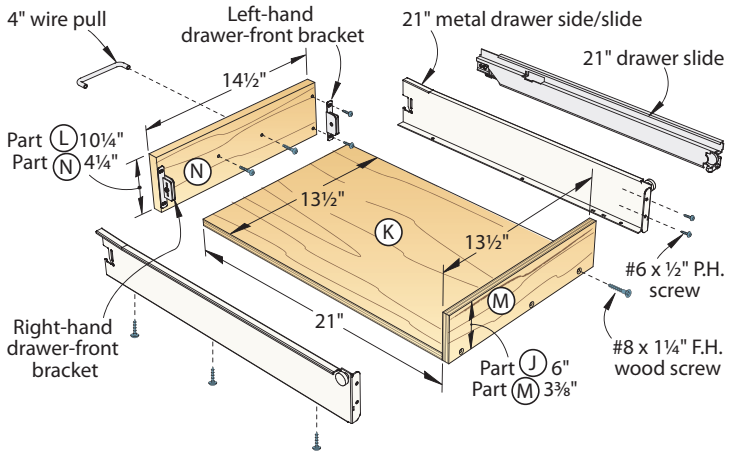
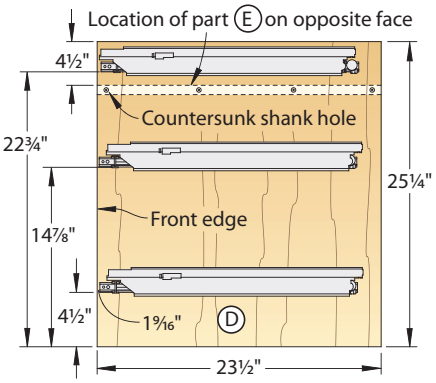
2 DRAWER ASSEMBLY



3 DRAWER SLIDE SPACING



8 Cut the top (I) to size [**Drawing 1**]. Center the top on the case, then drill and screw it to the top cleats (C). Mark the position of the 2"-diameter hole in the top where shown directly above the hole in the shelf. Clamp a piece of scrap underneath the top there to prevent tear-out, and then drill the hole. Using a ⅜" round-over bit, round over the ends and edges of the top.

Build side/slide drawers

1 Cut the tall backs (J), drawer bottoms (K), tall fronts (L), short back (M), and short front (N) to size. Drill and screw each short and tall back to a drawer bottom with their edges flush [**Drawing 2**].

2 Hammer flat the tabs on the drawer side/slides [**Photo D**]. Then follow the side/slide manufacturer's instructions to drill and screw the side/slides to the drawer back/bottom assemblies (J/K and M/K) [**Photo E**].

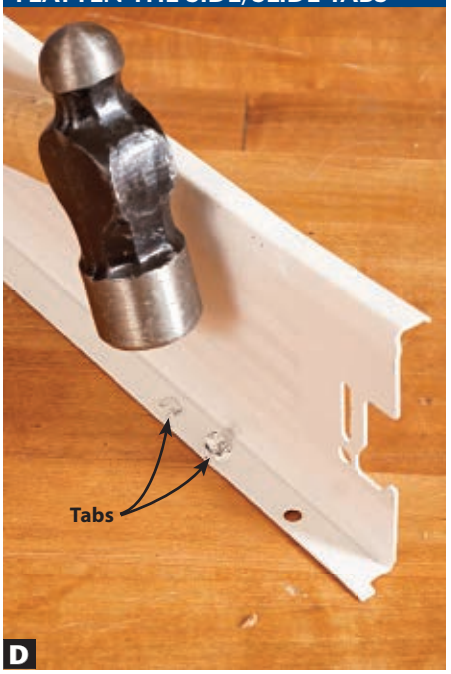
3 Screw the case-mounted part of the side slides to the divider (D) and right side (A) [**Drawing 3**]. Then screw the left and right drawer-front brackets to the side slides [**Drawing 2**], and insert the drawers into the case.

4 Cut a ⅛"-thick spacer about 12" long and rest it on the bottom (B). (You can also use two stacks of two quarters as spacers.) Apply double-faced tape to the front of each drawer-front bracket. Rest the lower tall front (L) on the spacer, and press it against the tape. Push the drawer out from the back, and drill and screw the brackets to the front.

5 In the same way, rest the ⅛"-thick spacer on the bottom tall-drawer front (L) and mount the middle tall-drawer front and the short-drawer front (N) to the drawer-front brackets. Then drill and screw a drawer pull centered on each drawer front.

6 If you plan to store shop-vacuum accessories on the cart, cut accessory

FLATTEN THE SIDE/SLIDE TABS

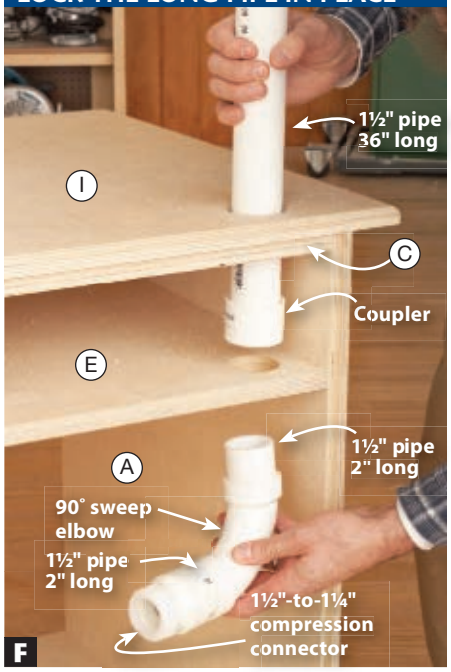


Hammer flat both tabs on the inside lip of each side/slide to allow the drawer bottoms (K) to rest flat against the side/slide lip.

SCREW SIDE/SLIDES TO THE BACKS

Drill and screw side/slide corner brackets to the drawer backs (J, M). Then drill and screw the side/slides to the drawer bottoms (K).

LOCK THE LONG PIPE IN PLACE



Capture the shelf (E) between a coupler and 90° sweep elbow to hold the long pipe steady on the cart.

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racks (O) and accessory dowels (P) to size. Customize the racks and dowel locations to suit your accessories. Then drill and screw the racks to the side (A) [**Drawing 1**].

Put together a dust duct

1 Cut three cord-holder (Q) blanks and make three copies of the **Cord Holder Pattern** from the *WOOD Patterns®* insert. Spray-adhere the patterns to the blanks. Drill 2" and ⅜" holes where shown. Then cut and sand the cord holders to the pattern lines.

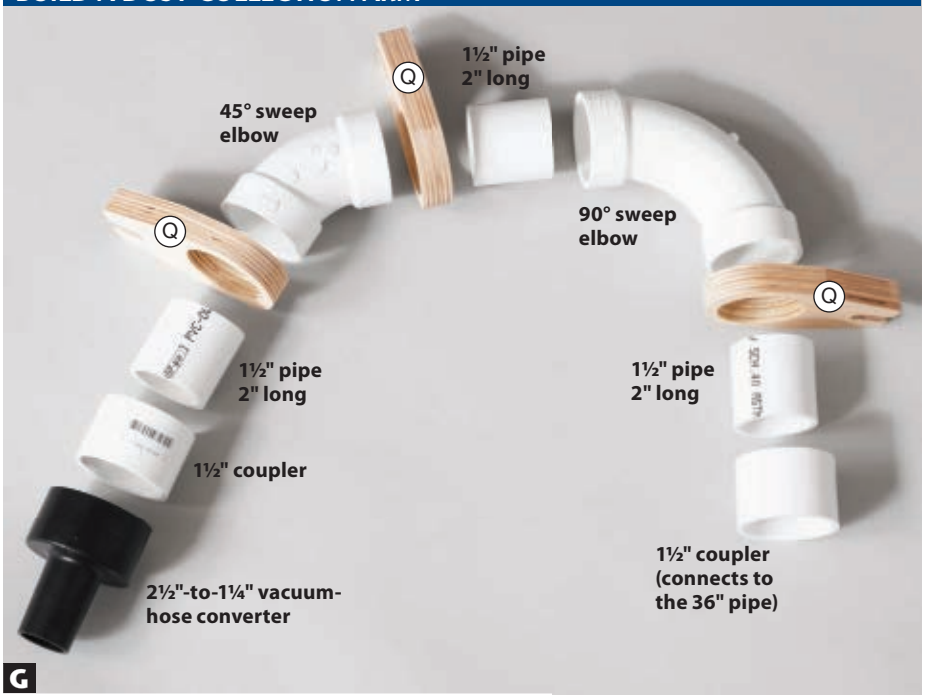
2 From 1½" PVC pipe, cut five 2"-long pieces and one 36"-long piece. Insert one end of the 36" pipe through the hole in the top (I), but not the shelf (E), and attach a coupler [**Photo F**]. ***Note:*** *Don't add epoxy to any PVC parts until after you complete the cart and apply a finish.*

3 Insert 2"-long pieces of 1½"-pipe into the ends of a 90° sweep elbow and add a 1½"-to-1¼" compression connector to one pipe to accept your shop-vacuum hose. Insert the other end through the shelf hole and into the coupler on the 36" pipe [**Drawing 1** and **Photo F**].

4 Lay out the PVC parts for the top assembly as shown [**Drawing 1**, **Photo G**] to test-fit them.

Quick Tip! Testing beats guessing. Shop-vacuum hose ends can vary in size by brand. If you can remove the hose end, take it to the store where you buy plumbing fittings. You may need to wrap electrical tape around a vacuum-hose end for a snug friction fit. Capture one cord holder (Q) between a coupler and the 90° sweep elbow [**Photo H**]. Repeat for the other two cord holders. On the assembly end nearest the 45°

BUILD A DUST-COLLECTION ARM



G

Alternate 2" lengths of pipe and PVC fittings to dry-assemble the dust-collector arm. The cord holders (Q) keep the sander's power cord up and out of your way.

CAPTURE THE CORD HOLDERS

H

Cord holders (Q) slip around pipes between fittings. Epoxy and pressure from the fittings against the holders keep them in position.

SHOP TIP

Add tool-triggered ease to any shop vacuum

Vacuums that automatically switch on and off with your sander can cost more than $500. But you can get the same convenience by simply plugging a low-cost vacuum—and your sander—into a $45 switch. (See **Sources** *next page.*) When you start the sander, the switch senses the power draw and sends current to the shop vacuum. The vac runs for a few more seconds after the sander stops to clear its hose. You can also set the switch to power a tool without turning on the vacuum.

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sweep elbow, attach the wide end of a 2½"-to-1¼" shop vacuum converter (see **Sources**, *below right*) to the coupler. Attach the other end of the converter directly to a shop vacuum hose with the hose end removed.

5 Remove the pipe and hardware and apply three coats of clear polyurethane finish to the cart and the cord holders (Q). Sand with 220 grit between coats. Reassemble the drawers, reinstall the hardware, and mount the tool-triggered vacuum switch (see **Sources**) where shown.

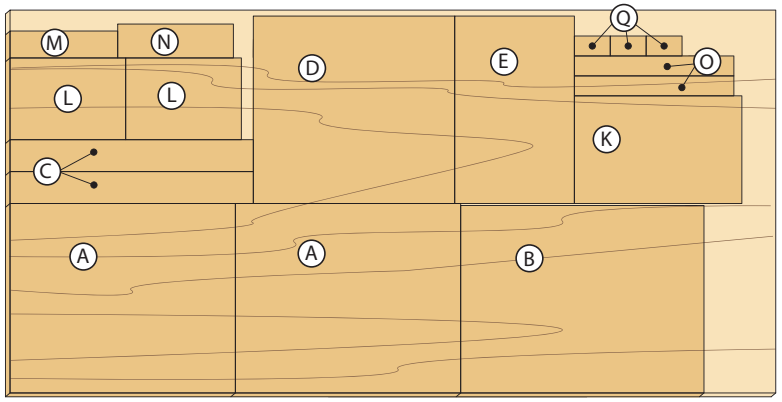
6 Orient the dust-collection assemblies on the top and bottom of the 36" pipe so the top points in the desired direction, with the bottom attached to your vacuum. Then join the parts using epoxy adhesive.

Quick Tip! Wipe off pipe markings. If you don't like the looks of those bar codes and lettering on your PVC fittings and pipes, remove them using a clean towel soaked in acetone. Turn the cloth frequently to keep a clean section against the pipe as you work to avoid smearing the ink.

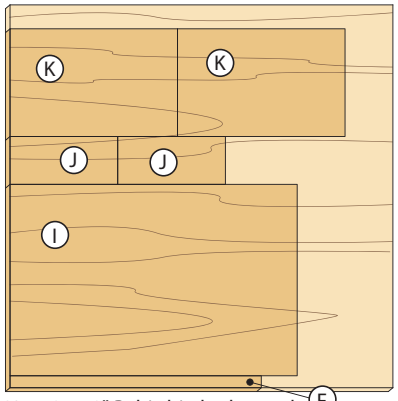
7 Drill and screw the back to the case. Connect your vacuum and sander to the tool-triggered vacuum switch. (See **Shop Tip** *on page 65*.) Now round up and store your sanding supplies in the three drawers, and put your sanding center to work on your next project.

Written by **Bob Wilson** with **Kevin Boyle**
Project design: **Jeff Mertz**
Illustrations: **Roxanne LeMoine**; **Lorna Johnson**

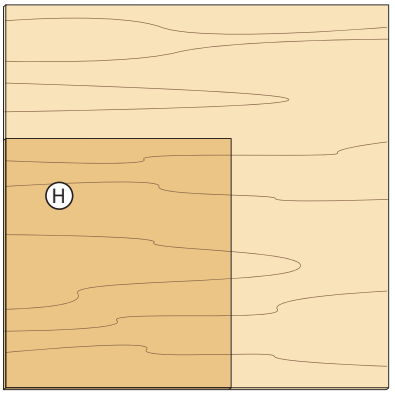
Cutting Diagram



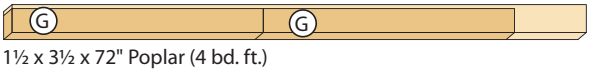
¾ x 48 x 96" Baltic birch plywood



¾ x 48 x 48" Baltic birch plywood



¼ x 48 x 48" Baltic birch plywood



1½ x 3½ x 72" Poplar (4 bd. ft.)

1" diameter x 36" Birch dowel

Materials List

Part		FINISHED SIZE T	W	L	Matl.	Qty.
Carcase						
A	sides	¾"	23¾"	28¼"	BP	2
B	bottom	¾"	23½"	30½"	BP	1
C	top cleats	¾"	4"	30½"	BP	2
D	divider	¾"	23½"	25¼"	BP	1
E	shelf	¾"	23½"	15"	BP	1
F*	bottom rail	¾"	1½"	30½"	BP	1
G*	caster blocks	1½"	3"	30½"	P	2
H	back	¼"	31¼"	28¼"	BP	1
I	top	¾"	24"	36"	BP	1
Drawers and accessories						
J	tall backs	¾"	6"	13½"	BP	2
K	drawer bottoms	¾"	13½"	21"	BP	3
L	tall fronts	¾"	10¼"	14½"	BP	2
M	short back	¾"	3⅜"	13½"	BP	1
N	short front	¾"	4¼"	14½"	BP	1
O	accessory racks	¾"	2½"	20"	BP	2
P	accessory dowels	1" dia.		2½"	BD	6
Q†	cord holders	¾"	2½"	4½"	BP	3

* Blanks initially cut oversize. See instructions.
† Blanks sized to accept patterns.

Materials key: BP–Baltic birch plywood, P–poplar, BD–birch dowel.
Supplies: #8×1¼", #8×2" flathead wood screws; #6×½", #12×1" panhead screws; 1½" 45° sweep elbow (1); 1½" 90° sweep elbows (2); 1½" couplers (3); 1½"-to-1¼" compression connector (1); 1½×48" PVC pipe (1). All are Schedule 40 pipe and fittings.
Blade and bits: ⅛" and ⅜" round-over router bits, 2" holesaw, ¼" or ⅜" bandsaw blade.

Sources

Tool-triggered vacuum switch. iVac Automated Vacuum Switch no. 149950, $45, Woodcraft, 800-225-1153, woodcraft.com.
Vacuum-hose converter. 2½"-to-1¼" converter no. 906-85-00, $7.19, Shop-Vac, shopvac.com or at many home centers.
Drawer side/slides. Blum C-15 Metabox medium-height no. B330M 5500C15W (1), $18 per pair; Blum C-15 Metabox high no B330H 5500C15W (2), $23.52 per pair; screw-on front brackets no. BZSF.1200 (3), $3.74 per pair, Woodworker's Hardware, 800-383-0130, wwhardware.com.
Casters. 4" locking swivel caster no. CHCMP13PBB (4), $10.89, Woodworker's Hardware.
Drawer pulls. Satin aluminum 4" no. S4484 27 (3), $3.67, Woodworker's Hardware.

MORE RESOURCES

FREE VIDEO
- "Making Super-Simple Drawers" woodmagazine.com/simpledrawer

FREE PLANS
- "Right-Angle Clamping Jig" woodmagazine.com/anglejig

RELATED ARTICLE
- "Reliably Rugged Assembly Table" Issue 196 (March 2010) or at woodmagazine.com/assembly table. $

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With no hardware, the drawer blends in to the cabinet. Open the secret drawer by poking your finger through a hole in the back of the tower.

Solid-Oak Tapered Display Tower

Biscuit joinery and no-fail angled setup blocks make construction a breeze.

Dimensions:
20⅜"W
× 18"D
× 61⅜"H

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Inspired by a Roycroft design from the early 1900s, this version replaces traditional through-tenon joinery with thoroughly modern and easy-to-do biscuits. What appear to be wedged through-tenons are actually glued-on false tenons. Up top, a blank drawer front blends into the design so well, you may not know it's there…until you learn the secret to opening it.

Make the sides and shelves

1 Edge-glue oversize panels for the sides (A) and shelves (B–G) [**Materials List**]. After the glue dries, rip the edges of the sides (A) parallel to each other, leaving each panel ¼" over finished width. Next, rip each shelf to finished width [**Drawing 1**].

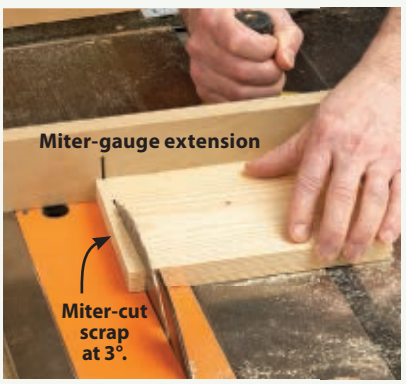
2 Using a 3° setup block as a gauge [**Shop Tip**, *below*], tilt the tablesaw blade 3° from vertical. Crosscut the sides (A) to final length, making sure the bevels on opposite ends of each piece are parallel [**Drawing 2**]. Crosscut the shelves (B–G) to length so the bevels mirror each other. ***Note:*** *The shelf lengths listed are for the longest (bottom) face.*

3 On the inside face of each side (A), lay out the tapers and the centerlines for shelves B and G [**Drawing 2**]. Along the back inside edge of each side, mark a line parallel to the taper line to indicate the ¼" rabbet that accepts the back.

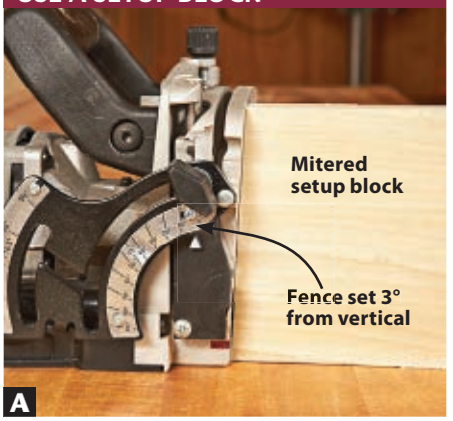
SHOP TIP

Angled setup blocks ensure accurate results

To accurately repeat the 3° bevel angles used throughout this project, make 3° miter cuts in five scraps at least 4" wide and 5" long. Use the blocks for tablesaw setups, positioning the biscuit-joiner fence [**Photo A**], and assembling the case [**Photos D** and **G**].

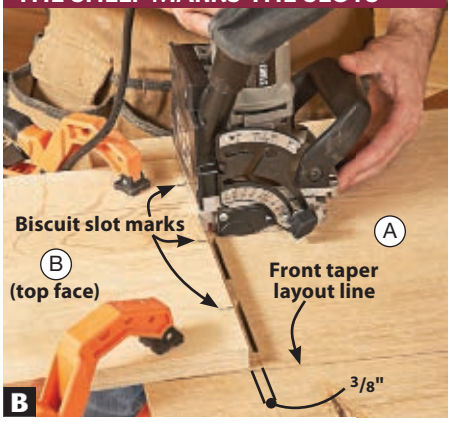


USE A SETUP BLOCK



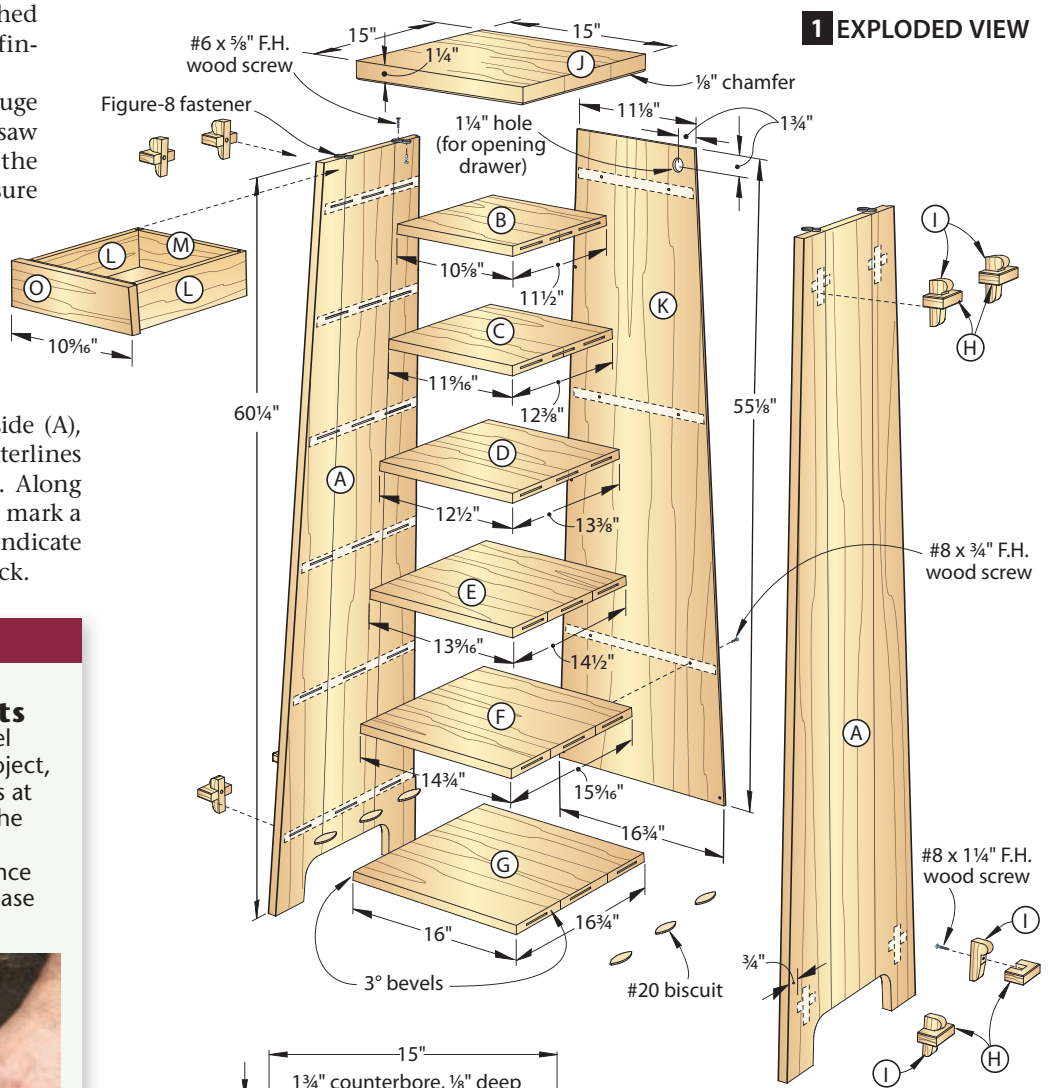
The biscuit slots cut in the sides (A) angle 3° downward from inside to outside. Use a setup block to adjust the fence angle.

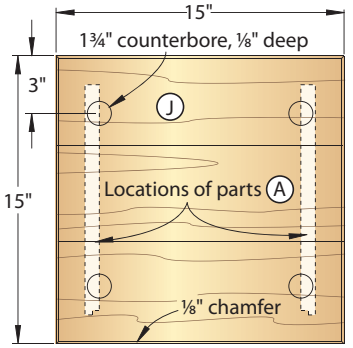
THE SHELF MARKS THE SLOTS



Use the beveled edge of the shelf to help position the biscuit joiner. Align the tool with marks on the shelf, then cut slots in the side.

1 EXPLODED VIEW





1a TOP DETAIL BOTTOM VIEW

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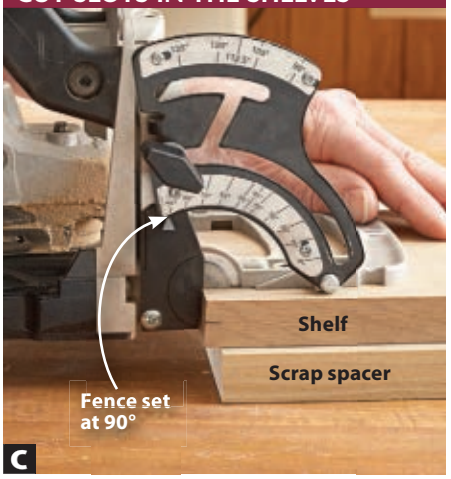
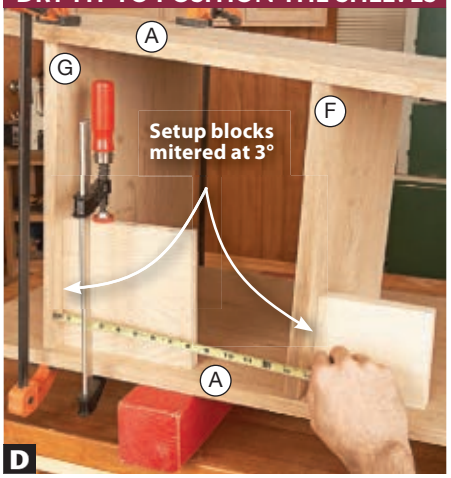
CUT SLOTS IN THE SHELVES



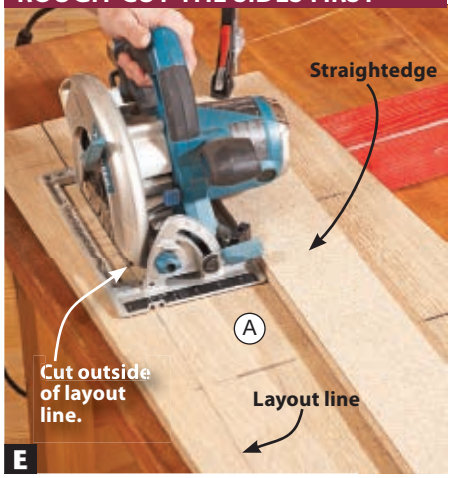
Elevate the shelves (B–G) on a scrap spacer, then cut slots at each mark, centered on the thickness of the shelves.

DRY-FIT TO POSITION THE SHELVES



Use the extra setup blocks to maintain the proper angle when positioning shelves B–G between the sides (A).

ROUGH-CUT THE SIDES FIRST



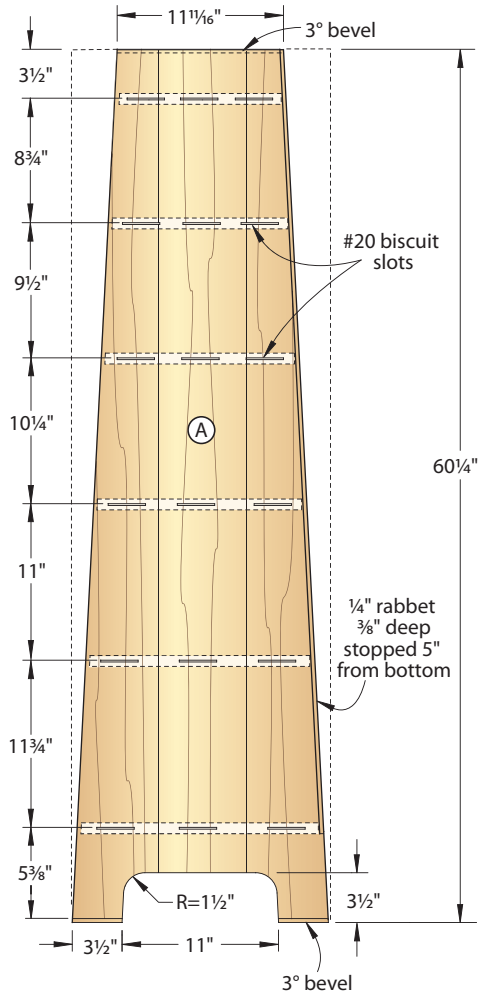
Clamp a straightedge to a side (A) so your saw cuts just outside the layout line. Trim both edges of each side using this method.

4 On the top face of each shelf (B–G), mark for three #20 biscuits—one centered and one 2" in from each edge. Set your biscuit-joiner fence 3° from vertical [**Photo A**]. Clamp shelf B to a side (A) ⅜" from the shelf-B centerline, and centered between the front taper line and the rabbet layout line [**Photo B**]. Cut the slots in the side. Repeat this process with shelf G, and on the opposite side (A).

5 Reset the fence on your biscuit joiner to 90° and cut slots in the shelves (B–G) [**Photo C**].

6 Determine the location in the sides of biscuit slots for shelves C–F by dry-fitting the sides (A), shelf B, and shelf G with biscuits [**Photo D**]. Position shelf F between the sides, measuring to ensure it is parallel to shelf G. Mark the center of shelf F's thickness on each side (A). Repeat this procedure for the remaining shelves. Disassemble the sides and shelves and, using a square and a pencil, extend the marks for shelves C–F across the inside faces of the sides. As before, set the biscuit joiner fence to 3° and use the shelves as story sticks to position the tool when cutting slots along these lines.

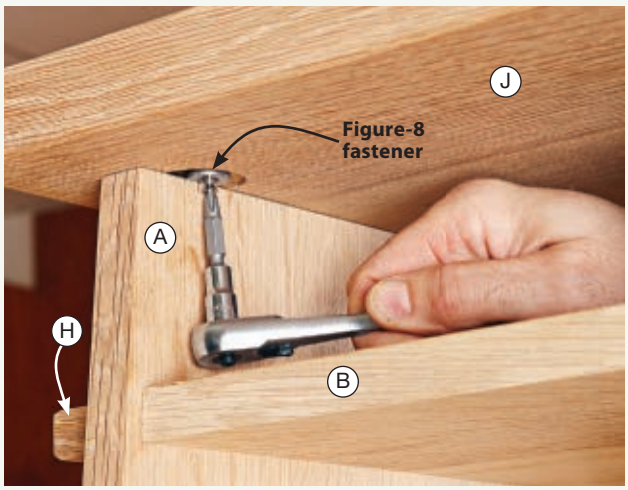
2 INSIDE VIEW OF LEFT SIDE



SHOP TIP

A twist for working in tight spots

Even a stubby screwdriver won't fit tight to the side (A) to drive the screws for the figure-8 fasteners. Instead, put a driver bit in a ¼" socket wrench. It reaches into the shallow opening, and the ratcheting action helps you work quickly.



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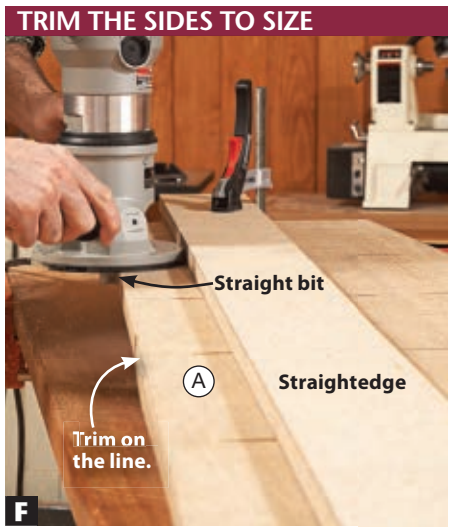
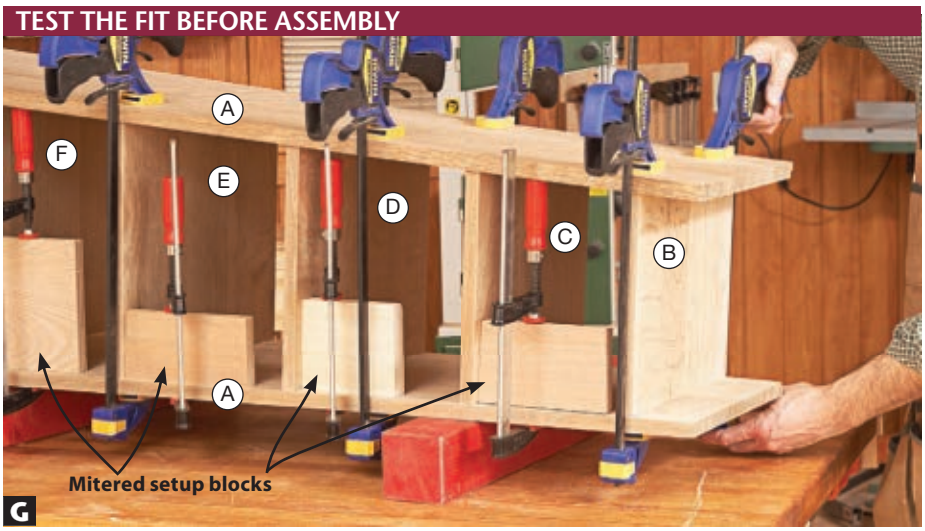


Mount a straight bit in your router, reposition the straightedge, and trim the sides to size.



Using biscuits in the slots and 3° set-up blocks, dry-fit the sides (A) and shelves (B–G). Check that the shelves are parallel.

7 Using a circular saw, straightedge, and router with a straight bit, cut the tapers on the sides (A) [**Photos E, F**]. Jigsaw and sand to shape the cutout at the bottom of each side [**Drawing 2**].

8 Switch to a ¼" rabbeting bit and rout the stopped rabbet along the back edge of each side (A) [**Drawing 2**]. Square up the bottom end of each rabbet with a chisel. Sand the sides and shelves (B–G) to 220 grit, then dry-fit the pieces with biscuits to check the fit [**Photo G**] before gluing the tower together.

Wedged tenons the easy way

1 Cut a ¾×2½×16" blank for the false tenons (H), bevel-ripping one edge at 3°. Make eight copies of the **False Tenon Top View** pattern from the *WOOD Patterns®* insert. Spray-adhere the patterns to the blank with at least ¼" between them. Cut the tenons to length, then bandsaw the notches. Rout the chamfers on the outside edges. Use mineral spirits to remove the patterns, then sand the false tenons to 220 grit.

2 Prepare a ¾×1½×30" blank for the wedges (I). Make eight photocopies of the **Wedge Pattern** and spray-adhere them to the blank. Bandsaw the wedges to shape, then sand them to 220 grit.

3 Dry-fit a wedge (I) to each false tenon (H). Drill countersunk 5/32" shank holes through the wedges and 7/64" pilot holes in the tenons. Screw the pieces together [**Drawing 1**]. ***Note:*** *The longest face of each tenon goes up.* Place a piece of 100-grit sandpaper on your bench. Rub the back edge of each assembly across it until the surfaces are flush, maintaining the 3° bevel. Sand the back faces to 150 grit, then glue the false tenon and wedge assemblies to the case [**Photo H**].

Top it off and back it up

1 Edge-glue a 1¼"-thick panel for the top (J) [**Drawing 1**] and cut it to size. Rout a ⅛" chamfer around the bottom edge. Center the top on the sides (A) and mark where the sides touch the top [**Drawing 1a**]. Lay out the counterbores for the figure-8 fasteners and drill them in the top.

2 Center the top (J) on the sides again and transfer the locations of the counterbores to the sides (A). Screw the figure-8 fasteners to these marks, then place the top back in position [**Photo I**]. Transfer the figure-8 fastener hole locations to the counterbores in the top and drill 3/32" pilot holes on the marks. Screw the top in place [**Shop Tip,** *page 70*].

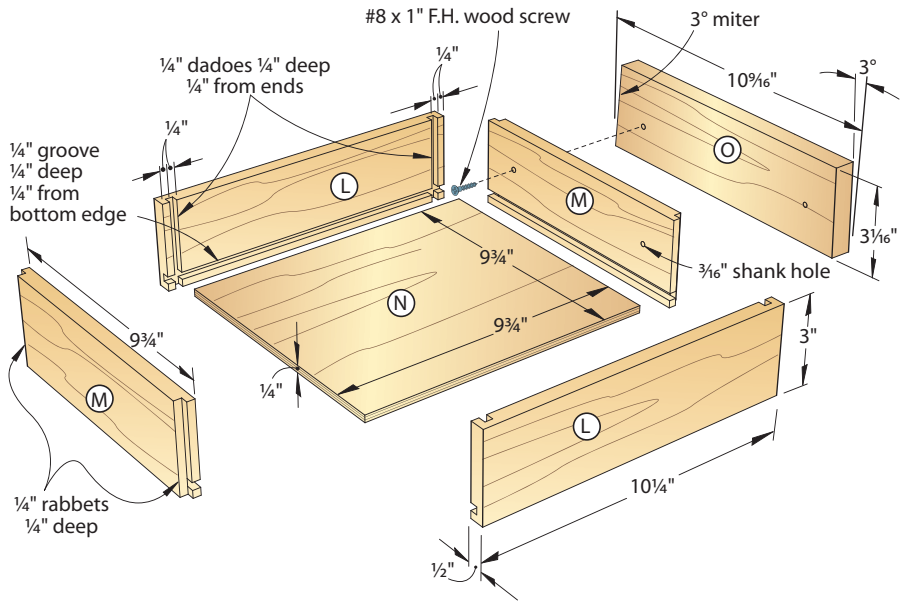
3 From ¼" plywood, cut the back (K) to fit into the rabbet in the sides (A) [**Drawing 1**]. Drill the 1¼" hole toward the top, then set the back aside.

Build a drawer

1 Cut the drawer sides (L) and front/back (M) to size [**Drawing 3**]. Cut a ¼" rabbet on each end of the front/back. Cut a ¼" dado across the end of each side to fit the tongue in the front/back. (See **More Resources** for a free video on this procedure.)

2 Plow a groove ¼" from the bottom edge of the sides (L) and front/back (M) to fit the plywood for the bottom

3 DRAWER (viewed from back)



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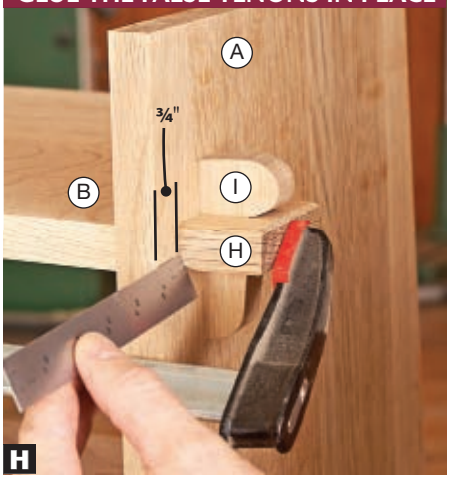
(N). Cut the bottom to size, then dry-fit the drawer to check the fit of the parts and the fit of the drawer into its opening. Glue and clamp the drawer together, checking it for square.

3 To determine the width of the drawer false front (O), measure the height of the drawer opening and subtract 1/16". Crosscut the false front 1/2" longer than the drawer opening's width. Use a setup block to position the miter-gauge head at 3°, then miter-cut each end of the false front [**Drawing 3**]. Sneak up on the final length until the false front fits the opening with 1/16" clearance. Drill 3/16" shank holes in the drawer front (M) and 7/64" pilot holes in the false front. Screw the false front to the drawer front and check the fit of the drawer in the tower.

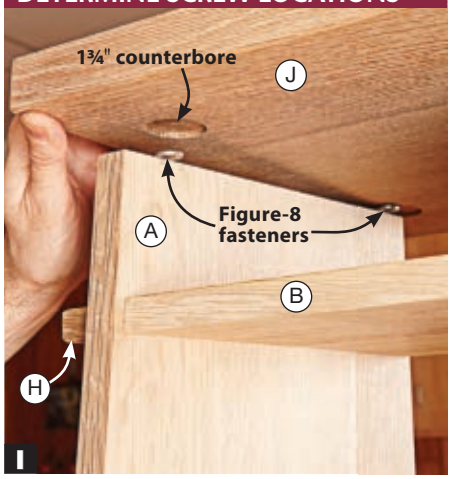
4 Remove the drawer false front (O). Stain the tower (A–J), back (K), and false front. (To get the traditional look of ammonia-fumed oak without all the trouble, we applied Lockwood dye no. 144 Early American Maple Golden Amber, followed by a coat of Varathane Traditional Pecan stain.) Allow the finish to dry thoroughly, then apply a clear topcoat to all pieces. (We brushed on three coats of a satin-finish water-based polyurethane, buffing between coats with a 320-grit sanding sponge.)

GLUE THE FALSE TENONS IN PLACE



Visually align the false tenons (H) with shelves B and G. Position each false tenon ¾" from the edge of the side (A).

DETERMINE SCREW LOCATIONS



Screw figure-8 fasteners to each side (A) so the counterbores cover them, then mark each fastener's screw location in the counterbore.

5 After the topcoat dries, screw the back (K) in place [**Drawing 1**]. Screw the drawer false front (O) to the drawer front (M), then slide the drawer into the opening. To open the drawer, reach into the hole in the back and push the drawer forward.

Produced by **Craig Ruegsegger** with **Kevin Boyle**
Project design: **Kevin Boyle**
Illustrations: **Roxanne LeMoine; Lorna Johnson**

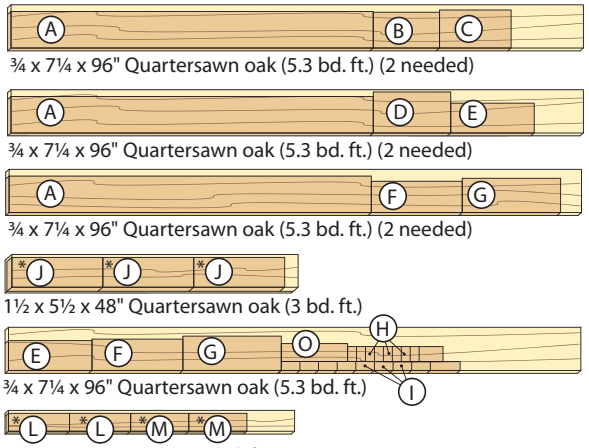
Materials List

Part		FINISHED SIZE T	W	L	Matl.	Qty.
A*	sides	¾"	18"	60¼"	QO	2
B*	shelf B	¾"	11½"	10⅝"	QO	1
C*	shelf C	¾"	12⅜"	11⁹⁄₁₆"	QO	1
D*	shelf D	¾"	13⅜"	12½"	QO	1
E*	shelf E	¾"	14½"	13⁹⁄₁₆"	QO	1
F*	shelf F	¾"	15⁹⁄₁₆"	14¾"	QO	1
G*	shelf G	¾"	16¾"	16"	QO	1
H*	false tenons	¾"	2½"	1½"	QO	8
I*	wedges	¾"	1⁵⁄₁₆"	3⅛"	QO	8
J*	top	1¼"	15"	15"	QO	1
K*	back	¼"	16¾"	55⅛"	QOP	1
Drawer						
L	sides	½"	3"	10¼"	M	2
M	front/back	½"	3"	9¾"	M	2
N	bottom	¼"	9¾"	9¾"	QOP	1
O*	false front	¾"	3⅛"	10⁹⁄₁₆"	QO	1

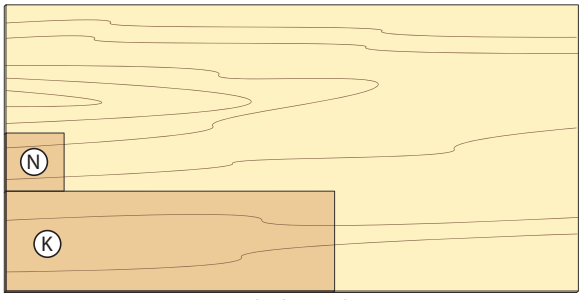
*Parts initially cut oversize. See the instructions.

Materials key: QO–quartersawn oak, QOP–quartersawn oak plywood, M–maple.
Supplies: Spray adhesive, #20 biscuits (36), #8×¾" flathead wood screws (6), #8×1" flathead wood screws (2), #8×1¼" flathead wood screws (8), #6×⅝" flathead wood screws (8), figure-8 fasteners (4).
Bits: ¼" rabbeting, 45° chamfer, ½" straight router bits; 1¼", 1¾" Forstner bits.

Cutting Diagram



*Plane or resaw to the thickness listed in the Materials List.



¼ x 48 x 96" Quartersawn oak plywood

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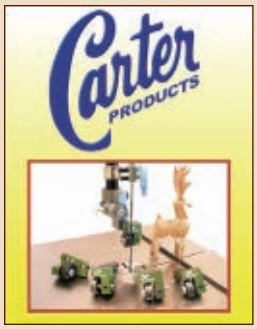

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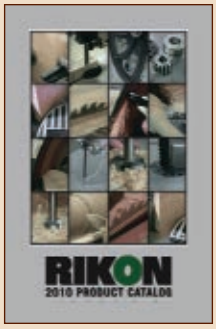

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Create a Celtic Knot

Add an accent that turns heads and gets friends asking, "How'd you do that?"

Don't let the curves or fine lines of this eye-catching inlay fool you. To make your own, simply cut kerfs in a squared turning blank, glue in splines built up from contrasting veneers, then shape it on the lathe.

To demonstrate the process, we incorporated a Celtic knot in the Table Lamp from issue 177 (July 2007) [**inset**]. The procedure adapts easily to a variety of turnings.

Define your splines

To determine the thickness of the splines, use your tablesaw to cut a kerf through a piece of scrap. Stack layers of veneer to fit snugly in the kerf [**Photo A**].

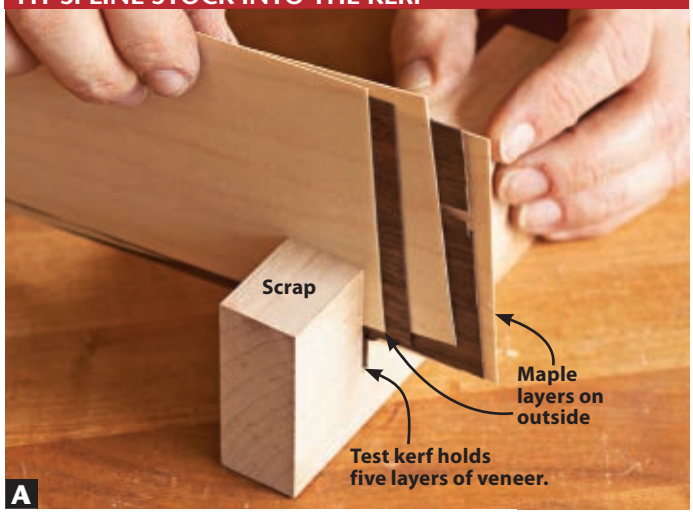
Cut a 3×12" strip of veneer for each layer and true up one long edge of each strip.

Make a veneer press out of two pieces of ¾"-thick plywood, covering one face of each piece with painter's tape to prevent glue from adhering to the plywood. Any wood glue will work for this step, but for speed we chose five-minute epoxy to laminate the veneers [**Photos B, C**]. After the epoxy cures, unclamp the press, scrape away any tape sticking to the lamination, and true up one edge.

Blank and tablesaw prep

For the knot to appear balanced and even, your turning blank must be

FIT SPLINE STOCK INTO THE KERF



Stack veneers to determine how many layers will fit. Maple veneers on the outside will contrast with the walnut turning blank.

LAMINATE A SPLINE BLANK

Tape a layer of veneer to the press, spread five-minute epoxy, and tape the next layer down. Work quickly before the epoxy sets.

continued on page 78

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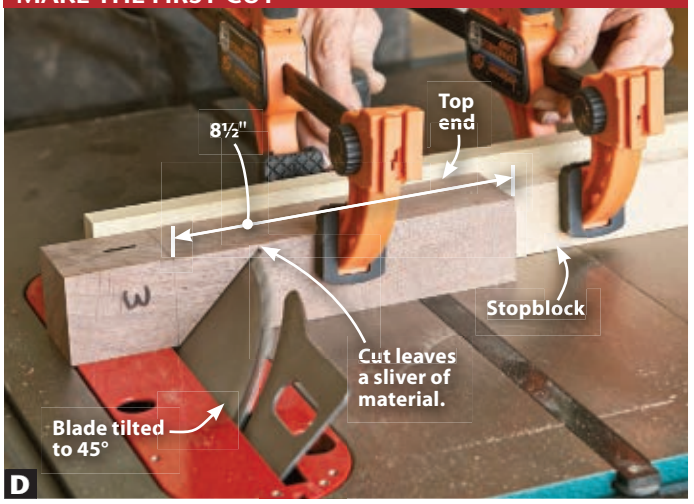
CLAMP DOWN FIRMLY

C

With epoxy applied between all the veneer layers, clamp the press to your bench. Wait for the epoxy to cure fully.

MAKE THE FIRST CUT



D

Position the blank with its top against the stopblock and with the "1" label facing up. The cut leaves about ⅛" of material at the top.

GLUE IN THE SPLINE

E

Place the trued-up edge of the spline against the kerf bottom. Clamp the blank as shown. The veneer press catches any epoxy drips.

LAY OUT THE SHAFT SHAPE

F

To lay out the shape of the lamp shaft, align the "2" diam." mark on the pattern with the middle intersection of two rings.

square in profile. After squaring it up and cutting it to length, rotate it and number adjacent faces in this order: 1-3-2-4.

Tilt your tablesaw blade to 45° and raise the blade so that it stops ⅛" short of cutting all the way through the blank. (A 2¼"-square blank was the thickest we could use, as our blade reaches 2⅛" above the table.) Attach an extension to your miter gauge and cut a kerf through it. Clamp a stopblock to the extension to position the knot in the desired position on your blank. (For the lamp, we set the stopblock 8½" from the bottom of the kerf.)

Kerf, glue, repeat

With the face numbered "1" up, cut a kerf through the turning blank [**Photo D**]. Mix up a small amount of five-minute epoxy, and glue and clamp the laminated spline blank into the kerf [**Photo E**]. After the epoxy cures, bandsaw away the excess spline and sand the spline flush with the faces of the blank.

Repeat this process on the remaining three faces, cutting in numerical order.

Now, to the lathe

Turning the blank round reveals the Celtic knot. (Follow the instructions in issue 177 for turning the lamp [**Photo F**]. Aligning the pattern as shown *above* centers the knot where the shaft tapers away evenly in both directions, keeping the knot symmetrical.)

MORE RESOURCES

RELATED ARTICLE

- To buy the complete plan and patterns for the Turned Lamp, go to woodmagazine.com/plans and type "turned lamp" in the search box.

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- Watch a Celtic knot being created in a pen blank using a bandsaw instead of a tablesaw at woodmagazine.com/homework

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Quick & Easy Jig

Joinery Routing Guide

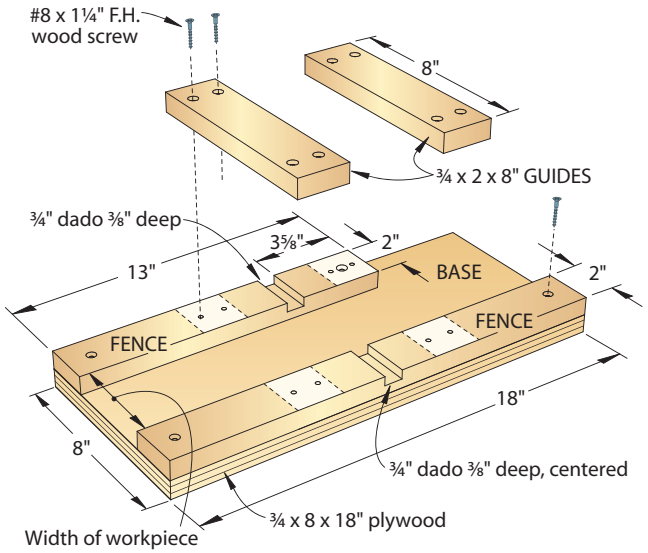
Reach for your router and this jig to cut clean, accurate dadoes, rabbets, and half-laps.

Use this handy, all-in-one jig to rout parts for the hall table on *page 40*. Or change the base dimensions and the fence thickness to rout parts for other projects.

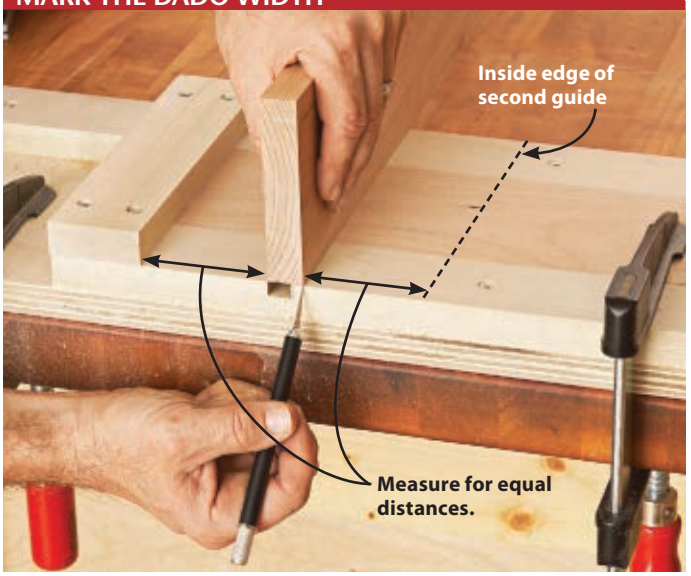
To make this version, cut a ¾×8×18" plywood base, shown *below*. Then cut the remaining jig parts from a 2×48" blank that's a hair thicker than your workpieces. Drill countersunk pilot holes and screw the 18"-long fence to the base with the edges and ends flush. Place a workpiece against that fence and butt the edge of the 13"-long fence against the workpiece. Drill and screw the 13" fence in place.

Quick Tip: Add shims for clearance. If you don't have a planer to size the fences thicker than your project parts, raise the fences by inserting kraft-paper shims to provide clearance. Now drill and screw one router guide 90°

ROUTING GUIDE



MARK THE DADO WIDTH



Hold a workpiece against the edge of the first dado pass and score the jig. Then measure to position the other guide.

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to the two fences and flush with the end of the 13" fence. Then place a scrap the width and thickness of your workpiece in the jig under the router guide and clamp it in place.

Note: *Before making the first routing pass, consult your router owner's manual and center the router baseplate around the collet. Or make a mark on top of the router base and hold that mark against the jig guide when making each pass. That way, the bit travels the same distance from the guides as you rout.*

Chuck a ½" straight bit in your router set to cut the rabbet or dado depth. Hold the router base against the guide and cut the first pass across both fences and the test scrap.

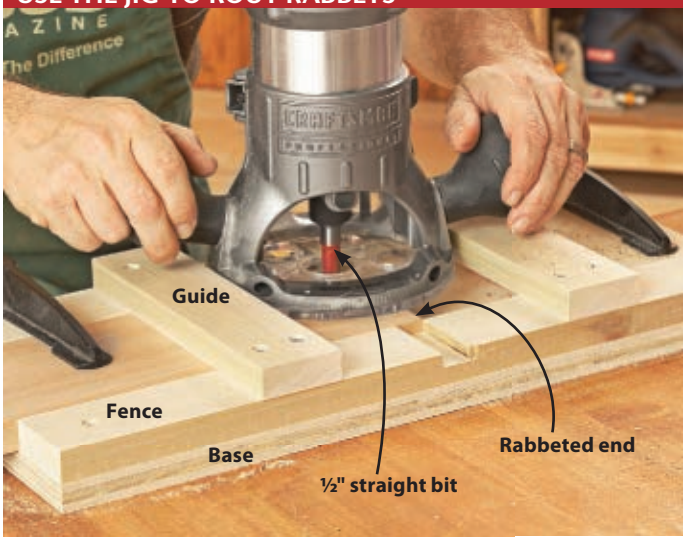
To position the second guide, hold your mating workpiece (or a scrap the same thickness) against the edge of the dado, as shown on *page 80*. Use a craft knife to score its thickness on the edge of the fence. Then measure from the edge of the guide to the nearest edge of the dado. Measure that distance from your score mark to a point along the fence. Drill and screw the second guide there, 90° to the fences.

Now rout a second pass holding the router against the second guide and check the fit of the dado using the mating piece from your project. Adjust the second guide if necessary.

Put your new jig to work

For routing dadoes, rabbets, and half-laps, mark a joint edge and waste area on your workpiece, as shown at the top of *page 80*, and set your bit depth. For dadoes, align the workpiece mark with the fence dadoes, clamp the workpiece in position, and rout one pass against each guide.

USE THE JIG TO ROUT RABBETS



Press the router base against one guide to rabbet a straight line. Repeat against the other guides to complete the rabbet.

Quick Tip: Reset your routing depth quickly. To repeat a router bit depth setup, place the router on one of the jig fences and lower the bit until it just touches the bottom of the fence dado.

For rabbets the same width as your dadoes, place the end of the workpiece just over the fence dado, as shown *above*, and rout against both guides. To make half-laps, unclamp the workpiece after each pair of passes and slide it along the jig. Repeat until you rout the full width of the half-lap.

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How to enlarge plans

Q: The Rocking Horse plans from *WOOD*® magazine issue 193 (October 2009) say to enlarge the patterns by 200 percent or download and print the full-size patterns. I don't have access to a computer or printer. How do I enlarge the plans?

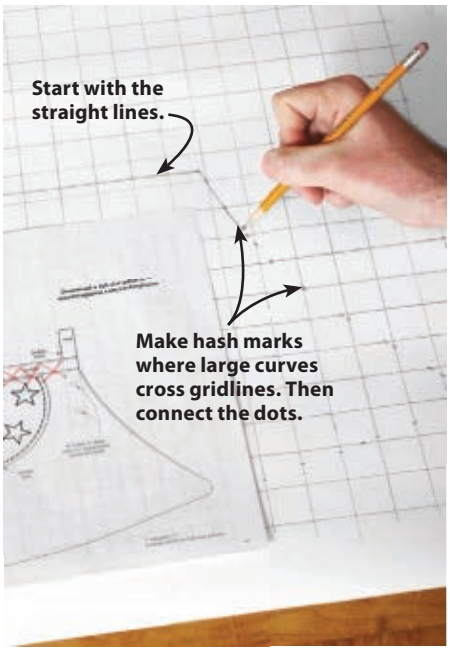
—David Elzey, Convoy, Ohio

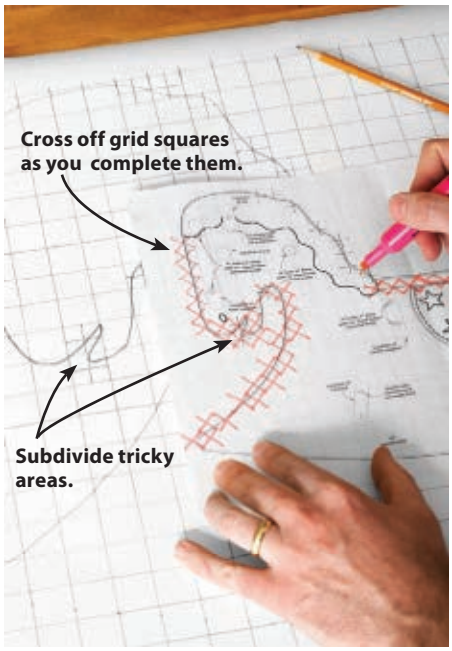
A: David, if you're near a copy shop that can print on poster-size paper, refer them to this web address—woodmagazine.com/rockinghorse—and ask them to download and print a copy of the 2×3', full-size plans.

Or, enlarge the plans by hand. Use a straightedge to create a 20×30" grid of 1" squares—a 200 percent enlargement of the ½"-gridded plans in the issue.

Start with the easy stuff. Counting boxes to determine their locations, draw in any straight lines and large curves, as shown *near right*.

Where the pattern contains small details or compound curves that change direction mid-grid-box, use a straightedge to subdivide both the miniaturized plan and the enlargement grid, as shown *above*. This will make the details easier to fill in.





Use these techniques to quickly and accurately enlarge or reduce patterns.

Plane Orientation

Q: The more I learn about hand tools, the more questions I have. For instance, what are Japanese hand planes? Are they better than my regular bench planes?

—Jared Watts, Richmond, Va.

A: Japanese planes differ from Western planes in several key ways, Jared. The first thing you'll notice: their elegant simplicity, with blocky bodies of tight-grained Japanese oak. And no fancy adjusters here: The irons are wedged in place by the chip-breaker pin. Rather than mechanical devices, a mallet-tap on either the body or the blade adjusts the iron.

Western woodworkers consider the Japanese planes "backwards" because you pull rather than push them. Experienced users say they achieve much better control with this technique, but it takes some practice to retrain your muscles.

To learn more about Japanese tools, read *Japanese Woodworking Tools: Their Tradition, Spirit, and Use*, by Toshio Odate (available from Amazon.com).

continued on page 84

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Amazing New Hybrid Runs Without Gas

The new face of time? Stauer's Compendium Hybrid fuses form and functionality for UNDER $50! Read on...

Innovation is the path to the future. Stauer takes that seriously. That's why we developed the ***Compendium Hybrid***, a stunningly-designed hybrid chronograph with over one dozen analog and digital functions that is more versatile than any watch that we have ever engineered.

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The watch's extraordinary dial seamlessly blends an analog watch face with a stylish digital display. Three super-bright luminous hands keep time along the inner dial, while a trio of circular LCD windows track the hour, minutes and seconds. An eye-catching digital semi-circle animates in time with the second hand and shows the day of the week. The watch also features a rotating bezel, stopwatch and alarm functions and blue, electro-luminescence backlight. The ***Compendium Hybrid*** secures with a rugged stainless steel band and is water-resistant to 3 ATMs.

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Ask WOOD

Does anti-lead mean anti-toy?

Q: What ever happened to that lead-in-toys law? My woodworking club wants to start making toys for Christmas charities soon, but we're worried we'll run afoul of the law.

—Robert Shultz, South Point, Ohio

A: Recent updates to the Consumer Product Safety Improvement Act (CPSIA) could affect your plans, Robert. A quick refresher: In 2007, several toy companies' imported products were found to contain illegal amounts of lead. In response, Congress enacted the CPSIA, which requires manufacturers to provide documentation from third-party labs certifying that their childrens' products meet minimal lead and phthalate (plastic softeners) limits.

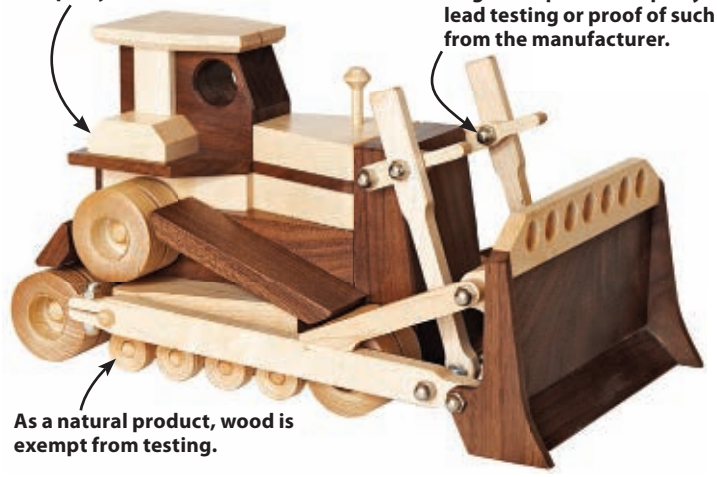
Following outcries concerning the high cost of testing, the Consumer Products Safety Commission (CPSC), charged with CPSIA enforcement, twice pushed back the compliance deadline in order to interpret the broadly-worded law. The deadline is now February 10, 2011. Unfortunately for woodworkers, finishes are not covered by this deadline extension. So, adding a finish to your project invokes the third-party testing requirement today.

However, the CPSC has adopted an interim policy of "component testing," meaning if woodworkers can provide documentation from all of their suppliers that hardware, glue, finish, etc. have been tested and certified by third-party labs to meet the lead requirements, then the complete product is in compliance. This has the potential to shift the burden of expensive third-party testing from the wood-worker to the component manufacturers. Contact the manufacturers to see if they have such documentation.

The fact that your club is creating the items for charity, rather than for sale, doesn't let you off the hook. According to Patty Davis, CPSC spokesperson, "Regardless of whether you're selling it or giving it away, if it's for a child, it needs to be in compliance with the law."

A finish immediately invokes the testing rule, necessitating a certificate of conformity from a third-party lab or the manufacturer.

After February 10, 2011, every piece of hardware and all glue require third-party lead testing or proof of such from the manufacturer.



As a natural product, wood is exempt from testing.

Planning on making the bulldozer on *page 56* for charitable donation? Here's how the CPSIA might affect your plans.

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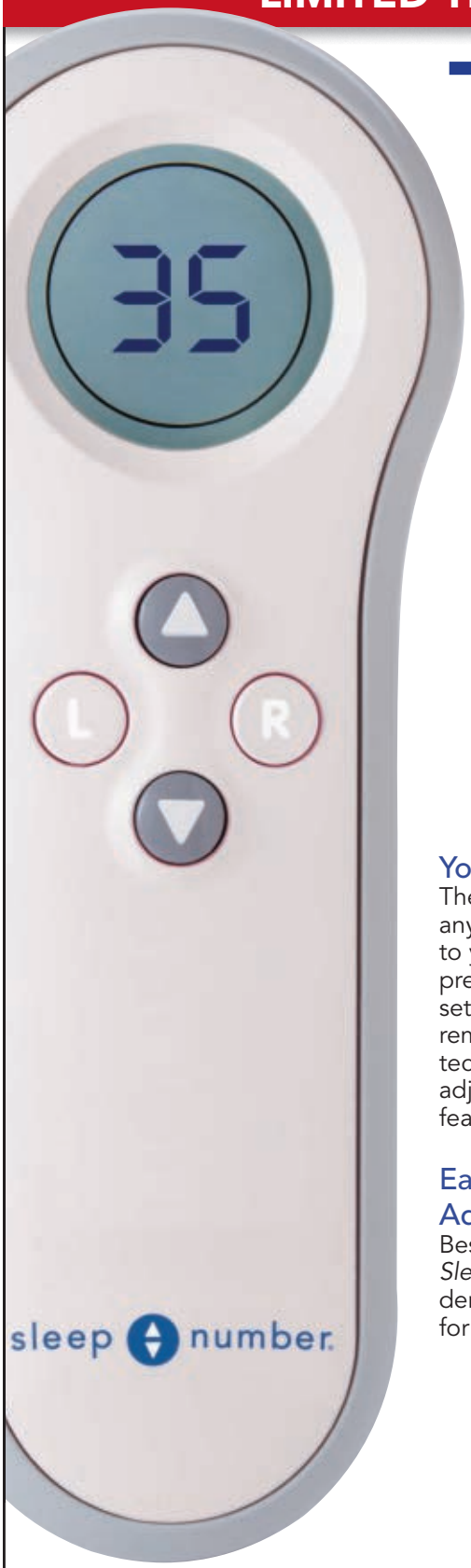

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About our product tests

We test hundreds of tools and accessories, but only those that earn at least three stars for performance make the final cut and appear in this section. Prices are current at the time of article production and do not include shipping, where applicable.

Feature-laden planer delivers top-notch cut quality

Delta's 13" 22-590 wasn't yet on the market when I tested benchtop planers in issue 196 (March 2010), but had it been included, its performance would have placed it among the leaders. Its three-knife cutterhead leaves an excellent surface on the wood, and the improved dust hood—now with a centered port and wider collection throat—evacuates chips better than the old model. Initially, I thought I'd miss the slower feed rate—available on its two-speed predecessor—but the 22-590's cut quality at 90 cuts per inch proved flawless with sharp knives.

But even at that 26-feet-per-minute feed rate, the brawny 22-590 hogged off 1/16" from 13"-wide red oak without bogging down. And I really like the preset thickness stops, shown at *right*. It still has six stops from 1/8" to 1¼", but it also features markings in 1/32" increments. Although these don't have stops, you just line up the mark with the indicator and lock the ring in place. Another great feature: The depth-of-cut gauge bar spans the full opening of the machine, so it works accurately even if you're planing a narrow board along the side stops.

On the downside, no matter how much I tried to adjust the infeed and outfeed tables, I could not eliminate snipe. At its best, the .003"-deep snipe can be removed with moderate power sanding. Oddly, snipe actually increased slightly when I engaged the cutterhead carriage lock, so I simply quit using it with no consequence.

—Tested by Bob Baker, a three-decade woodworker and former manager of a woodworking store

13" Benchtop Planer, #22-590

Performance	★★★★½
Price	$450

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Parallel feather boards make setup easier

The router table in my shop plays a crucial role in almost every project I build, so I appreciate the convenience and reliability of JessEm's Paralign Feather Boards. (For the record: They work just as well on a tablesaw.) With a two-stage locking system, I first aligned the black carriage part parallel to the miter slot and tightened it. Then I slid the red finger part forward against my workpiece and tightened it. This is a big improvement over one-piece feather boards I've used, which can shift as you tighten them, effectively losing alignment.

I do have a couple of gripes. The fingers were a little stiff for my preference, making it tough to gauge the correct amount of force. And the knobs on each feather board got in the way of pushsticks on narrow workpieces.

JessEm sells these in single or dual units; the stacked models come apart for use as singles when needed. All models come with a miter-slot bar and T-nuts for use in T-track.

—Tested by Matt Seiler, a custom-furnituremaker

Paralign Feather Boards

Performance		★★★★☆
Price	Single, #4015	$22
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Shelf-Pin Drilling Jigs

Why buy?

A shelf-pin drilling jig ensures wobble-free adjustable shelves by helping you drill precisely positioned pin holes. We found two jig styles: a plastic or phenolic template with a single fence, and parallel aluminum guides. The template style comes with a self-centering ¼"-diameter brad-point bit, but you also can get a 5mm bit for smaller pins or slightly larger bits for brass sleeves (shown *below*). The parallel-rail type are built for heavy use and cost four to five times as much. (You supply your own drill bits for these.) We tested five template jigs and two rail jigs, and recommend the three *below*.

PEACHTREE DRILLRITE, #853, $32

Test-drive:

I found this no-fuss jig easy to understand and use. Its wood fence squares easily to the two rows of guide holes, should it ever get out of alignment. To use it, simply clamp the jig against the workpiece edge lined up with your layout marks, and then drill as many as you need. To drill more in that same line, reposition the jig so the last hole drilled lines up with the ¼" or 5mm indexing hole, and insert a shelf pin. Then drill more holes and repeat as needed. This jig's self-centering bit cleared chips better than its competitors thanks to a larger cutout on both sides of its body.

—Tested by Steve Feeney, a woodworker with 25 years experience and a WOOD® *magazine tool tester for 5 years*

To learn more:

Peachtree Woodworking, 888-512-9069, ptreeusa.com

Vertical hole spacing: 1¼"
Horizontal row spacing: 1½" & 2½" from fence
Standard hole size/included bit: ¼"
Optional bits: 5mm

ROCKLER JIG-IT, #32991, $35

Test-drive:

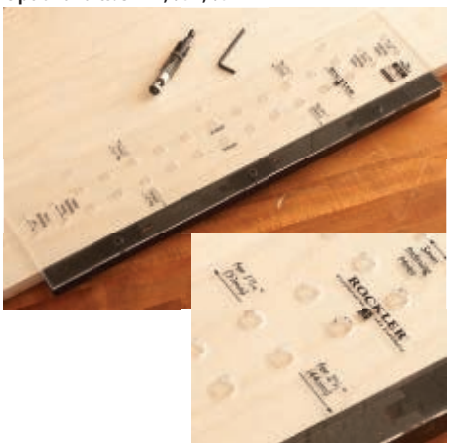
Although similar to the Peachtree in size, function, and price, the Jig-It also provides onboard storage in its fence for the included ¼" bit and setscrew hex wrench. Great idea, but protruding latches on the compartment doors prevent the fence from sitting flat on the benchtop when clamped to a ¾"-thick workpiece. So I had to hang it over the edge of the bench—a minor inconvenience. Rockler offers 7/32" and 9/32" self-centering bits for drilling larger holes to accept brass shelf-pin sleeves that fit 5mm or ¼" pins (shown *above*). Both work perfectly with this jig with no adaptation required, so this single jig lets you drill all the common pin-hole sizes.

—Tested by Steve Feeney

To learn more:

Rockler Woodworking, 800-279-4441, rockler.com

Vertical hole spacing: 1¼"
Horizontal row spacing: 1½" & 2½" from fence
Standard hole size/included bit: ¼"
Optional bits: 5mm, 7/32", 9/32"



VERITAS, #05J03.03, $165

Test-drive:

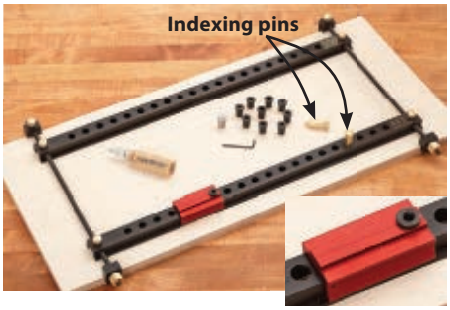
I know it's a lot to pay for a shelf-pin jig, but the Veritas offers far greater versatility than the plastic-template jigs. It comes with drilling bushings in 10 sizes, giving you more choices for shelf pins than you'll probably ever need. The hardened bushings fit into a small carrier that mounts to the rails and ensures holes drilled square to the wood surface. When I needed to drill more holes inline with those just made, it was easy to align using the two brass indexing pins. This jig's 24"-long guide rails can be located anywhere along the self-clamping perpendicular clamp rods, letting me place pins as near or far from the edges as I wanted. The included rods let me clamp to work-pieces up to 12" wide, but I recommend getting at least one set of optional long rods that extend the width capacity to 24" ($14) or 36" ($16).

—Tested by Kevin Boyle, Senior Design Editor

To learn more:

Lee Valley, 800-871-8158, leevalley.com

Vertical hole spacing: 1"
Horizontal row spacing: variable up to 11"
Standard hole sizes: 7/32", ¼", 3/8" and 5, 6, 6¾, 7, 7½, 8, and 9mm
Uses standard brad-point drill bits; no bits included



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What's Ahead

Coming up in the October 2010 issue (on sale August 24)

Lighted Pedestal
A lamp shining through the veneered acrylic panels of this cherry table adds a warm woodworking glow to any room.

Bread-Dipping Tray
Serve up fresh bread and seasoned oils on this easy project. A simple jig and router-bushing kit help you create perfect recesses for the dishes and tray insert.

Arts-and-Crafts Bench
Simple biscuit joinery makes this classic piece doable even for beginners. You'll find a handy source for just the right stock to build it.

Do-It-All Routers
Looking for one router that can handle every task in your shop? We test nine routers—six multibase kits and three dedicated plunge models—in search of the tool that meets all your handheld or table-mounted needs.

Dado Duel
Our shop experts go head-to-head to see which tool—router or tablesaw—best helps you quickly cut clean dadoes, grooves, and rabbets for cabinet construction.

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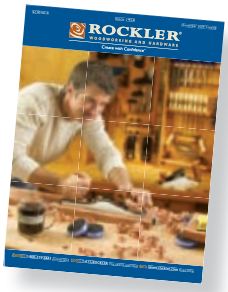

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